Issue #299

OUR 25th ANNIVERSARY YEAR!

August 1985
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A CWC/P Publication

International Edition

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Hunting the Auto-Fox

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New VHF/UHF Column: Above and Beyond

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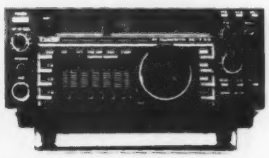

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- A patch should work with any radio. AM, FM, ACSB, relay switched or synthesized.
- Patch performance should not be dependent on the T/R speed of your radio.
- Your patch should sound just like your home phone.
- There should not be any sampling noises to distract you and rob important syllables. The best phone patches do not use the cheap sampling method. (Did you know that the competition uses VOX rather than sampling in their $1000 commercial model?)
- A patch should disconnect automatically if the number dialed is busy.
- A patch should be flexible. You should be able to use it simplex, repeater aided simplex, or semi-duplex.
- A patch should allow you to manually connect any mobile or HT on your local repeater to the phone system for a fully automatic conversation. Someone may need to report an emergency!
- A patch should not become erratic when the mobile is noisy.
- You should be able to use a power amplifier on your base to extend range.
- You should be able to connect a patch to the MIC and EXT. speaker jack of your radio for a quick and effortless interface.
- You should be able to connect a patch to three points inside your radio (VOL high side, PTT, MIC) so that the patch does not interfere with the use of the radio and the VOL. and SQ. settings do not affect the patch.
- A patch should have MOV lightning protectors.
- Your patch should be made in the USA where consultation and factory service are immediately available.

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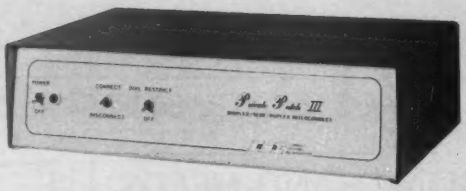

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With a flick of the new connect switch you can patch your friends on the repeater into the phone system. One of them may need to report an emergency!

No hassles with busy signals! If you call a number that is busy, just put your MIC down and relax. PRIVATE PATCH III will disconnect automatically.

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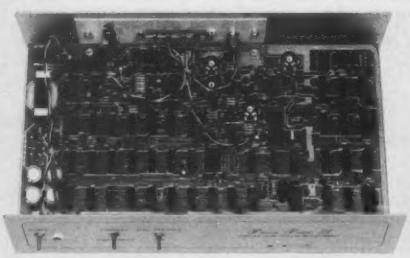

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ISSUE #299 AUGUST 1985

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CWC/P's Margaret Baker, Creative Director, Marketing/Graphic Services Division, was captured on film by Frank Cordell of Bennington NH. FT-209RH courtesy of Yaesu Electronics Corporation, Paramount CA.

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WHAT?

News from the Publisher

Dr. Marc Leavey WA3AJR celebrated his *eighth* anniversary with *73* earlier this year, and I did want to make sure that his hard work and ninety-six-plus "RTTY Loop" columns didn't go unrecognized. In our reader polls over the years, "RTTY Loop" has always ranked right up near the top of the preferred features list, a reflection no doubt not just of continuing interest in radioteletype, but also of the skill and care evident in WA3AJR's column every month. Thanks, Marc!

Our appreciation and congratulations go also to Bob Baker WB2GFE, our "Contests" columnist, who this month marks his *tenth* anniversary with *73*. As WA1SCX in 1975, Bob found himself president of a newly-formed ham club at Digital Equipment Corporation. "One of our very first programs was a talk given by Wayne Green, who had been invited down for the evening. After dinner, I joked about *73* not having a contest column. I was challenged to start something and that's how the contest calendar got started." The author of more than 75 published articles, Bob is now the Manager of Software Development for Datamedia Corporation in Pennsauken, New Jersey, and owner of his own small supplies and software business, Baker Enterprises. Fortunately for us all, he still finds time for contesting, DX, and county hunting, and—most important—for writing our "Contests" column. On behalf of our staff and readers, Bob, many thanks and best wishes for *at least* another successful ten!

Speaking of columns, I call your attention to Perry KW1O's "QRX" this month, where you'll find news of proposals approved by the ARRL Executive Committee to enhance Novice privileges. The idea here is not just to attract new Novices, but to retain them in the Amateur Radio Service—to make Novice operation and opportunities more FUN. Please drop me a line and let me know what you think about these ideas. We think they have merit.

The mailbag does continue to be full every day, and we do thank you for taking the time to send along your thoughts and comments, your QSLs, your club newsletters, and news items of interest about everything under the sun. We're always interested in what's going on in your neck of the woods, and the best way we find out is by you letting us know what's happening. Here's a reminder, too, that we do make random follow-up calls to letter-writers to talk in greater depth with them about their ideas for amateur radio and for *73*. This month's calls went to hams in the states of New Hampshire, New York, and California, as well as to one in London.

This month's *incoming* call-of-the-month was great. We were in the midst of some very severe weather—high winds, torrential downpour, yellow-brown skies. The phone rang (beeped actually) and the caller identified himself as a New Hampshire ham. It was important, he said—he had to speak to KW1O. Well, there was a real sense of urgency in his voice and New Hampshire *has* had tornadoes, so I left the phone off the hook and scrambled to find Perry. I told him I thought it could be an emergency, and Perry rushed into my office and picked up the phone. Then he rolled his eyes and smiled. No emergency. The guy was just *really* excited about getting on computerized RTTY as soon as possible. Could we tell him how? Another new fan for "RTTY Loop"!

Jack Burnett

MPA

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QRX. . .

EDITED BY PERRY DONHAM KW1O

Novice Phone?

THE ARRL EXECUTIVE COMMITTEE has approved a plan which would allow Novices greater privileges, including phone operation on three bands. The proposal, developed by the League's headquarters staff, calls for Novice voice and data transmission on the 28-, 220-, and 1200-MHz bands. On ten meters, Novices would be allowed CW and data emissions from 28.1 to 28.3 MHz and CW and SSB from 28.3 to 28.5 MHz. From 220 to 225 MHz, they would be given all voice and data modes with a power limitation of 25 Watts output and a prohibition against operating a repeater. Between 1246 and 1260 MHz, privileges would be similar to those on 220 MHz, with an output limit of 5 Watts. The plan also calls for an increase in the number of questions in the Element 2 examination from 20 to 30 to reflect the added responsibility of the new modes of operation. Technicians, of course, would gain the new HF authorization. So that General-, Advanced-, and Extra-class ticket-holders do not feel slighted, they would be able to use full output power within the new Novice subbands. Please note that approval by the Committee is only a first step on the road to proposed rulemaking. FCC Special Services Division Chief **Ray Kowalski,** in a telephone interview with the *W5YI Report*, said, "Expanding Novice privileges is not being considered in response to a problem, but rather to...keep amateur radio attractive and vital with new blood." *73* will keep you up to date on this important issue through this column and the *73* RBBS at (603)-924-9809.

Micro DX

A NEW NORTH AMERICAN DX RECORD on 1296 MHz may have been set by **Ott Fiebel W4WSR** and **Wes Atchison WA5TKU.** Ott and fellow experimenter **Al Ward WB5LUA** tried for nearly a year to bridge the 1073-mile gap between their stations and establish a new terrestrial 1296-MHz record. Not until June 3, 1985, did favorable conditions appear. In Ott's words, "I commenced our sked at 0100 UTC and stood by. Al came back with such a signal that I thought it was a local trying to break in! We immediately switched to SSB and exchanged 59+ reports. Boy, when this band opens, it *opens!* We switched to 70 cm to spread the good news...Wes WA5TKU joined...and we proceeded to try our luck on 23 cm. Wes is another 39 miles west of Al and doesn't have near the setup Al has, but we had to try anyway. At 1137 UTC I copied Wes RST 529 and he gave me a 549. To the best of my knowledge, this contact establishes a new North American record of 1112 miles!" Poor Al had waited nearly a year to hold the record for only a few minutes.

Kansas Sitting

A UNANIMOUS VOTE of the Kansas Repeater Council will keep that state on the 15-kHz repeater band plan. Meeting in Salina, the group heard reports from **Frank Park** and **Joe Eisenberg** concerning the technical and compatibility aspects of 15- versus 20-kHz splits. In approving the proposal to stay with the 15-kHz plan, the council also affirmed its desire to remain compatible with neighboring states Colorado, Nebraska, Iowa, and Missouri, all of which have also rejected the 20-kHz band plan.

Debutant

"ABOVE AND BEYOND," *73*'s new VHF/UHF column, debuts this month. **Peter Putman KT2B** will offer a variety of information each month, such as product reviews, grid-square news, expedition announcements, and operating techniques. You may recognize Pete's name from his amazing multiple-projector slide shows on contesting or his inventive construction articles. At home, he uses mainly home-brewed gear, with a kilowatt on 144 MHz, 120 Watts on 220 MHz, 500 Watts on 432 MHz, and 20 Watts on 1296 MHz. If you are a VHFer or would like to be one, why not drop Pete a note and let him know what sort of thing you would like to read about? His address is 84 Burnham Road, Morris Plains NJ 07950.

Soviet Solution

ARE YOU FRUSTRATED by having to wait such a long time for QSLs to arrive from the USSR? **Ed Kritsky KA2MXO** may have just the thing for your anxiety. Box 88 is not the only way to QSL the Russians, and to prove it Ed has produced a complete list of oblast-level QSL bureau addresses. In a story which appeared recently in the *DX'ers Magazine*, Ed says, "It is perfectly all right for you to QSL directly using this info. People who already have done it report very good results." Ed is selling the list for $4.95 and is using the money to send *Callbooks* and other ham-radio literature to Soviet amateurs. You can contact Ed at PO Box 715, Brooklyn NY 11230.

Radio Police

"DON'T BE A PROBLEM," said FCC Commissioner **Ray Kowalski** to a conference of repeater coordinators at the Dayton Hamvention. Kowalski, addressing a forum on VHF spectrum management, made it clear that he is concerned about the future of amateur radio. "The current political mode for dealing with problems is to get rid of them," he explained. "You are sitting on very valuable spectrum. There are sharks out there who have mentioned that spectrum and would love [to have] it. Think on how it plays in the halls of the FCC if someone says, 'This has become a problem service; let's get rid of it. It will go away and we can give that spectrum to people who need it [instead] of a bunch of hobbyists.' That's how it will play if it comes down to a solution to solve a problem. *Do not* become a problem." More specifically, the Commissioner chided hams for running so quickly to the FCC with every little problem. Kowalski reminded the group that amateur radio is a self-policing service and that we should be able to solve our problems with a minimum of regulatory action. "Don't come running to us for some kind of policy or rulemaking...you won't like the solution!"

Hot Turkey

AMATEUR RADIO HAS TAKEN OFF in Turkey! Soon after the Turkish Parliament passed a bill allowing hams back on the air, seven operators received their licenses and began to assemble stations. Currently four amateurs are active: **Unal Akbal TA1A, Salim Unuvar TA1B, Metin Kutlu TA1C,** and **Mehmet Basak TA1D.** The remaining three, who have not yet received callsigns, are **Tuncer Topdemir, Aziz Sasa,** and **Mustafa Tandogan.** More license examinations are planned, so the activity level from this country should begin to slowly rise as more and more stations are established. For now, look for TA1A and TA1C on 15 and 20 meters from 1800 to 2300 UTC daily.

YAP

PRESIDENT REAGAN is indirectly backing amateur radio in a big way through the **Young Astronaut Program (YAP).** YAP, a group which consists of at least 50,000 schoolchildren enrolled in nearly 2,000 chapters nationwide, is part of the White House Office of Private Sector Initiatives. YAP Director **Dr. Kerry Joels** met recently with ARRL Development Manager **Bill Laz-**

zaro N2CF to talk about integrating amateur radio into YAP. The discussion centered around linking YAP chapters with local amateur-radio clubs and about the possibility of a joint YAP-AMSAT satellite. Dr. Joels said that he had found "strong corporate enthusiasm" for a proposed geosynchronous system which would be underwritten by industry contributions. The Young Astronaut Program has an incredible potential for bringing ham radio directly to children who are at that wonderful age when everything is new and exciting.

Clear As...

THE FCC HAS RECONSIDERED its recent editorial change of Section 97.121 which attempted to clear up apparent confusion as to when an amateur could transmit a callsign other than his own (after **David Popkin W2CC** politely pointed out that the new rule implied that *any* use of another callsign was prohibited). Luckily, the Commission agreed and has now reworded the offending paragraph to specify that amateurs simply must not transmit false or deceptive signals, including identifying with a call that is not assigned to the station. Of course, a guest operator at your station may still sign with his own call, providing he stays within the limitations of his license. And "tactical" calls on nets are still OK as long as the proper method of identification for this type of operation is observed.

Mag Mod

A5 ATV MAGAZINE has changed both its format and its name. The new ***Spec-Com Journal*** features a larger page size and an expanded focus on all forms of specialized amateur communications. In response to concerns that fast-scan TV would not be adequately covered, publisher **Mike Stone WB8QCD** replied, "*A5*'s readers have become specialty operators in modes other than ATV. [But] fast-scan television is the first interest of *Spec-Com*, and a large percentage of the publication will always reflect this." Get complete details on this new magazine by writing to *Spec-Com Specialized Communications Journal*, PO Box H, Lowden IA 52255.

More Stuff!

THE FLOOD OF FREEBIES from *73* continues with this month's incredible bargain: a newly-updated list of Volunteer Examiner Coordinators. That's right, all 31 FCC-appointed VECs on one convenient reference sheet. But that's not all! Limited supplies of the **Giant Worked All States Map** (11" × 17") are still available. Now how much would you pay? But wait—we'll throw in a copy of the popular **Ten-Meter Beacon List**, an information-packed aid you'll use again and again. All of these fantastic values can be had for the same low price—a large SASE sent to *73* Magazine, Editorial Department, 80 Pine Street, Peterborough NH 03458, Attn: VEC List.

Armadillos, Ho!

THE ARMADILLOS ARE RUNNING AGAIN in Texas! In 1983, the members of the **Texas DX Society** decided to try their hand at county hunting by activating all 254 Texas counties during the County Hunters CW contest. Fewer than 60 hams covered 262,000 square miles in less than 48 hours to accomplish the feat. In 1984, the club expanded the "Armadillo Run," as it came to be called, to include the states of Arkansas, Louisiana, and Mississippi. Now the group has even bigger plans—a national Armadillo Run! That's right, they will attempt to activate *every county in the United States* during the County Hunters phone and CW contests in May and July of 1986. Plans are already well under way for this amazing event, but you can still arrange to be in on the fun by contacting the 1986 Armadillo Run Coordinator, Tom Taormina K5RC, Route 1, Box 307, Manvel TX 77578.

Bulletin Bored?

AN INCREDIBLE NUMBER of computer-based bulletin boards has sprung up around the country, including one here at *73*. We'd like to put together a directory of ham-related systems in the United States —but we need your help. Jot down information about your favorite amateur-radio RBBS, including telephone number, baud rates supported, and special features, and send it to *73* Magazine, Editorial Department, 80 Pine Street, Peterborough NH 03458, Attn: RBBS. We'll compile a bulletin-board mini-directory and make it available through "QRX."

Ham Hero

ALAN GERSHBEIN W4LTA narrowly escaped death recently with the help of ham radio. While walking along a beach in the Bahamas, Alan stepped on what he first thought to be a shell, but was in fact a deadly stonefish. Within a short time, Alan's foot and ankle had swollen to nearly twice their normal size, and excruciating pain was shooting up his leg. He began to have trouble breathing. Alan instructed his wife Nancy to call for emergency medical assistance on the 14.313 Maritime Mobile Net with his new Kenwood TS-430S. Even though Nancy is not a ham, she knew that 14.313 MHz was programmed into one of the 430's memory channels and succeeded in calling up the frequency to the vfo. Luckily, Alan had just installed a J. L. Industries Antuner, which automatically matched the antenna's impedance to the transmitter's. Nancy called net control operator **Randy Maurer WA3HLP**, who kept the frequency clear and relayed instructions from the Tampa Poison Control Center. Nancy followed the Center's directions, and Alan's relief (and Nancy's!) was almost immediate.

Spread Specs

SPREAD-SPECTRUM COMMUNICATION has been approved for amateur use on frequencies above 420 MHz, but there is a catch. Although the final ruling has been published, it will be one year before any transmissions will be allowed. This is, according to the FCC, "in order to give the amateur community time to develop initial voluntary interoperability standards as they have done recently in packet radio." In other words, time to get our act together. There also will be a limit of three possible spreading sequences so that monitoring stations won't have to step through an infinite number of possibilities, and identification must be made in CW, SSB, or FM. The FCC is encouraging experimenters to apply for STAs. If you are interested in helping explore amateur spread-spectrum, get in touch with the Amateur Radio Research and Development Corporation (AMRAD) at PO Drawer 6148, McLean VA 22106-6148.

Preview

COMING UP NEXT MONTH in *73*: Antennas! That's right, it's time to get out and build that new antenna before winter sets in. You'll find skywires for every type of operation and every budget. Plus, we'll show you how to build and align the DSE Commander 2m transceiver. Of course you'll see all of your favorite features, including "Above and Beyond," our new VHF/UHF column. October? Our gala **Silver Anniversary Issue!**

Bravo!

SINCERE THANKS to Paul Courson WA3VJB, Bill Pasternak WA6ITF, the *AMRAD Newsletter*, H. Veysel Guleryuz, the *W5YI Report*, Tom Taormina K5RC, Gus Browning's *DX'ers Magazine*, Wendell Wilson W0TQ, Ott Fiebel W4WSR, Louis Perlmutter W4LP, George Wood of Radio Sweden International, *The TSRAC BNT*, and *The ARRL Letter* for helping out with this month's news.

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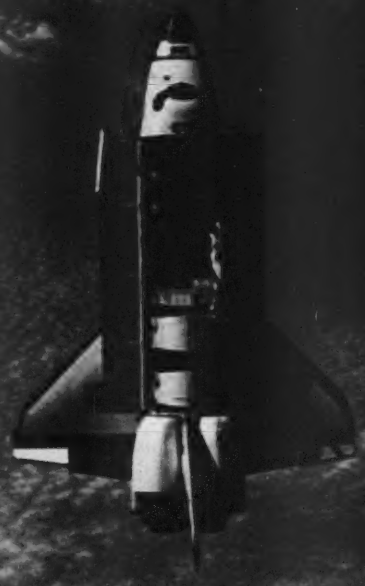

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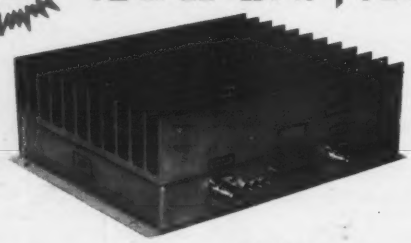

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IC-02AT

ICOM 2-Meter Handhelds

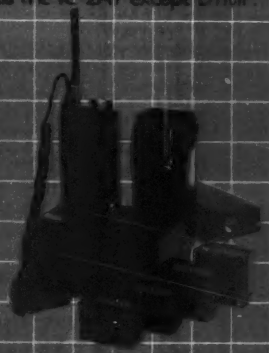
If you want a 2-meter handheld with exceptional features, quality built to last and a wide variety of interchangeable accessories, take a look at the ICOM IC-02AT and IC-2AT handhelds.

Frequency Coverage. The IC-02AT covers 140.000 through 161.550MHz and the IC-2AT, 141.500 through 149.995MHz, both include frequencies for MARS operation.

IC-02AT Features. ICOM's top-of-the-line IC-02AT handheld has the following outstanding features:

- DTMF direct keyboard entry
- LCD readout
- 3 watts standard, 5 watts optional (with IC-BP7 battery pack)
- 10 memories which store duplex offset and PL tone (odd offset can be stored in last 4 memories)
- Frequency dial lock
- Three scanning systems: priority, memory and programmable band scan (selectable increments of 5, 10, 15, 20 or 25KHz)

IC-2AT Features. The IC-2AT is ICOM's most popular handheld on the market. The IC-2AT features a DTMF pad, 1.5 watts output and thumbwheel frequency selection. The IC-2A is also available and has the same features as the IC-2AT except DTMF.



Accessories. A variety of slide-on battery packs are available for the IC-02AT and IC-2AT, including the new long-life 1000mAh IC-BP8 which can be used with both handhelds.

Other accessories include the HS-10 boom headset, HS-10SB PTT switchbox, HS-10SA VOX unit (for IC-02AT) and an assortment of battery pack chargers.

The IC-02AT and IC-2AT come standard with an IC-BP3 NiCd battery pack, flexible antenna, AC wall charger, belt-clip, wrist strap and ear plug. See the IC-02AT and IC-2AT 2-meter handhelds at your local ICOM dealer.

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios meet or exceed FCC regulations limiting spurious emissions. 02AT185

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Model	ELH 230D*
Frequency Range	144–148 MHz
Modes	FM-SSB-CW
Input Power	1W–3W
Output Power	30W
Power Source	DC 13.8V/45A
RX-Preamp (Approx.)	10 dB
Input & Output Impedance	50-Ohm
Dimensions (in.) (W × H × D)	3.64" × 1.64" × 6.52"
Net Wt. (Approx.)	1.11 Lbs.

*Note: Photo shows Model ELH 230G (without RX Preamp). Specs are otherwise the same. Other models available for 2M & 70CM.

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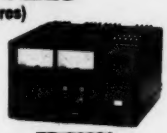
Output Voltage	10–15V DC (Adjustable)
Output Current	25A DC Cont.; 30A DC Max
Ripple Voltage	Under 30mV, P-P (Rated)
Power Consumption	770VA (Rated)
Circuit Protection System	Shut-down type, Auto current limiting
Dimensions (In.) (L × W × H)	13.34" × 9.6" × 6.32"
Weight	18.92 Lbs.



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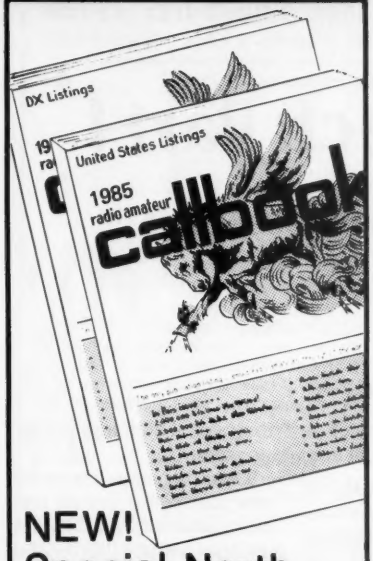

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The Downunda Project: Part I

Stone the crows! This fair dinkum 2m transceiver from Australia really scores a six!

Reprinted with permission from *Electronics Australia*.

By any standard, the UHF transceiver described in the September, October, and November, 1983, issues of *Electronics Australia* has been an outstanding success. Many hundreds have been successfully built and the kit supplier responsible, Dick Smith Electronics, has not been able to keep up with the demand.

As the reputation of the UHF transceiver has grown, more and more amateurs have decided to have a go at building a really worthwhile piece of gear for themselves. At the same time, they can save a substantial amount of money over the price of an equivalent commercial unit.

We're very glad to able to report this development because it signals a resurgence in the construction of gear amongst amateurs who, for a long time, have been content to buy rather than build.

Just as night follows day, there was bound to be a call for a two-meter version of the transceiver. The VHF version was just crying out to be produced.

Well, now it has happened. The same people that produced the UHF kit, Garry Crapp VK2YBX/T and Gill McPherson VK2ZGE, have put their thinking caps on and produced a two-meter transceiver that will certainly set any keen amateur longing.

Photo A. The DSE Commander two-meter transceiver kit.

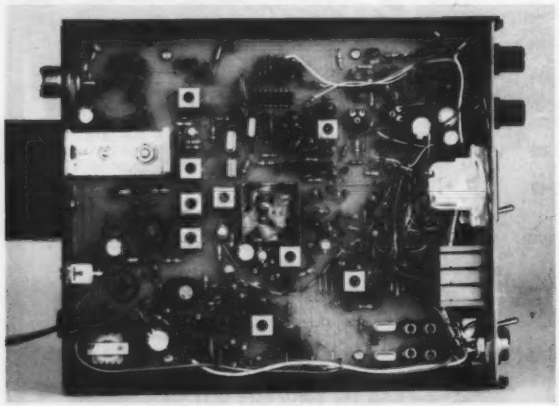

Photo B. Inside the Commander.

Features

As the accompanying spec panel shows, this new two-meter transceiver has very good performance which is matched by the features that most amateur-radio operators want. Note also that there are very few options available because they are all built into the basic radio.

Operating facilities on the new transceiver are all that most amateurs would want without all the "bells and whistles" of some of the more fancy models. There are none of those hard-to-remember-how-to-use memories, and the frequency readout and selection is via no-nonsense push-button-type thumbwheel switches.

As is usual practice with two-meter amateur transceivers, the two most significant digits of the frequency section are omitted, which means that there is an assumed decimal point between the first and second digits of the three-digit readout (i.e., 14-.--MHz). In Photo A, this means that the transceiver is set for a frequency of 148.42 MHz.

Standard controls for volume and squelch require little comment, as does the signal-strength/power meter. The microphone socket is a standard configuration allowing press-to-talk operation.

In addition, there is a three-position switch for sim-

A complete kit is available for $149 plus postage and handling from Dick Smith Electronics, PO Box 2249, Redwood City CA 94063.

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MFJ'S MOST ADVANCED RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE HAS FM, AM MODES, LED TUNING ARRAY, RS-232 INTERFACE, VARIABLE SHIFT TUNING, 170/850 Hz TRANSMIT, MARK-SPACE DETECTION.

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Engineering, performance, value and features sets MFJ's most advanced RTTY/ASCII/AMTOR/CW computer interface apart from others.

FM (limiting) mode gives easy, trouble-free operation. Best for general use, off-shift copy, drifting signals, and moderate signal and QRM levels.

AM (non-limiting) mode gives superior performance under weak signal conditions or when there are strong nearby stations.

Crosshair mark-space LED tuning array simulates scope ellipse for easy, accurate tuning even under poor signal-to-noise conditions. Mark and space outputs for true scope tuning.

Transmits on both 170 Hz and 850 Hz shift.

Built-in RS-232 interface, no extra cost.

Variable shift tuning lets you copy any shift between 100 and 1000 Hz and any speed (5-100 WPM RTTY/CW and up to 300 baud ASCII). Push button for 170 Hz shift.

Sharp multi-pole mark and space filters give true mark-space detection. Ganged pots give space passband tuning with constant bandwidth. Factory adjusted trim pots for optimum filter performance.

Multi-pole active filters are used for pre-limiter, mark, space and post detection filtering. Has automatic threshold correction. This advanced design gives good copy under QRM, weak signals and selective fading.

Has front panel sensitivity control.

Normal/Reverse switch eliminates retuning while checking for inverted RTTY. Speaker jack. +250 VDC loop output.

Exar 2206 sine wave generator gives phase continuous AFSK tones. Standard 2125 Hz mark and 2295/2975 Hz space. Microphone lines: AFSK out, AFSK ground, PTT out and PTT ground.

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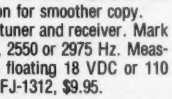

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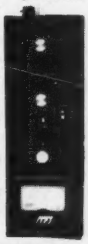

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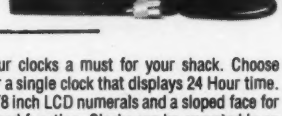

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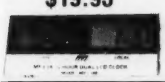

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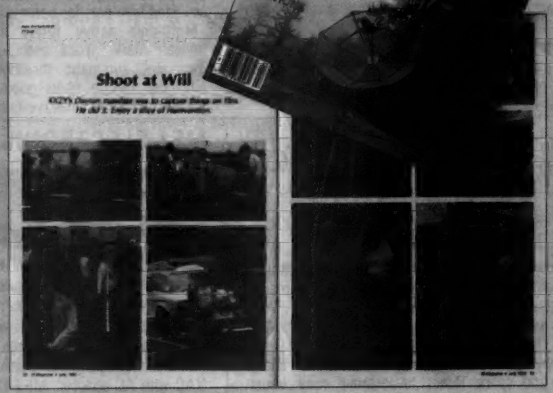

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plex and ±600-kHz transmitter offset for working into repeaters. There is also an anti-repeater (reverse) button so that the transceiver can be used to listen in on the repeater receiving frequency.

Finally, there is the 5-kHz offset switch which effectively doubles the number of channels from 400 to 800, albeit with 5-kHz channel spacing.

How It Works

For those not familiar with the series of articles on the UHF transceiver, let's now go through the block diagram, before attacking the main circuit diagram. Refer now to Fig. 1.

The block diagram shows that the transceiver is split into two sections, receiver and transmitter, which come together in the antenna filter. Both sections employ a common frequency synthesizer and voltage-controlled oscillator.

The receiver is a conventional double-conversion superheterodyne with intermediate frequencies at 10.7 MHz and 455 kHz. The second conversion from 10.7 MHz to 455 kHz is achieved in an integrated circuit which also includes limiting amplifiers and an FM quadrature detector. From there the signal is passed to an audio amplifier.

The vco (voltage-controlled oscillator) has two modes and, as you might have guessed, these are transmit and receive. In the transmit mode, the vco is set to an exact frequency within the range of 144 to 148 MHz by the frequency synthesizer which, in turn, is controlled by the offset oscillator. The output of the vco is fed via Q17 and Q18 to the rf power amplifier and thence via the antenna filter circuit to the output socket.

In the receive mode, the vco is set at a frequency exactly 10.7 MHz below the incoming frequency. This is necessary to give the 10.7-MHz intermediate frequency at the output of the mixer, Q7. The lower vco frequency is obtained by switching a different crystal into the offset oscillator.

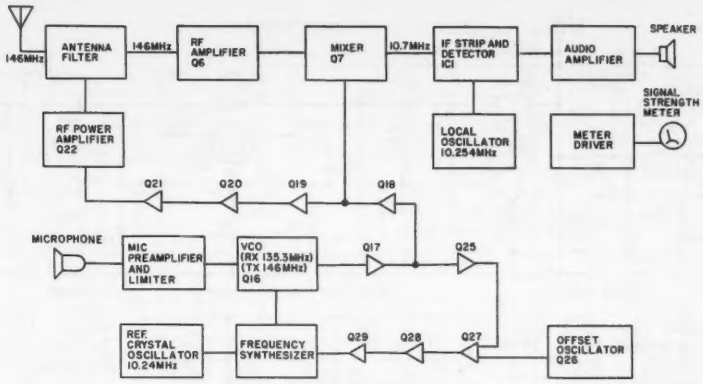

Fig. 1. Block diagram of the DSE Commander.

Circuit Details

Now let's have a look at the circuit diagram (Fig. 2). Don't shudder. We'll consider the receiver circuitry first.

Input signals from the antenna are fed via the antenna filter and rf-switching network on the extreme right-hand side of the circuit diagram. The signals pass via L30, L29, L27, L26, L28, and C123. From there they go to the input of Q6 via transformer L2 and C11 (on the extreme left-hand side of the circuit).

The rf switching is performed by D13 (near L28, on the right-hand side of circuitry). In the transmit mode, D13 is forward-biased and thus shorts out any rf signal from the transmitter which would otherwise be fed into the receiver input.

Q6 is a conventional common-emitter amplifier with L3 as its collector load. L3 is part of the three-stage bandpass filter which only accepts signals in the 144-to-148-MHz range.

MOSFET Q7 is the mixer. Gate 1 of Q7 is the incoming rf signal while gate 2 is the vco (local-oscillator) signal. L6 is the drain load of Q7 and the mixer output is the difference frequency, 10.7 MHz. This is passed via FL1, a two-pole filter, to IC1.

IC1 is a Motorola MC3357 device specifically designed for use in a narrowband FM dual-conversion communications receiver, which is exactly what this circuit is. We have already talked about the first conversion, which takes place in mixer Q7, from 144 (to 148 MHz) down to 10.7 MHz. The MC3357 handles the second conversion using an internal 10.245-MHz local oscillator.

This gives a second intermediate-frequency signal of 455 kHz which is amplified, limited, and detected by IC1. IC1 also provides the squelch function.

In greater detail, crystal X1 at pin 1 of IC1 sets the local-oscillator frequency to 10.245 MHz. This is internally mixed with the 10.7-MHz signal from Q7 to produce a 455-kHz i-f, which is then fed to an external filter at pin 3. Transistor Q8 amplifies the filtered 455-kHz signal and feeds it back into the limiting-amplifier input at pin 5.

The limiting amplifier is a five-stage differential amplifier which boosts the 455-kHz signal well into clipping, at its output. That is, we say the signal is limited. This effectively removes any amplitude variations (AM) so that the signal only contains frequency modulation.

The limited signal is then fed to the internal FM quadrature detector associated with coil L7 and capacitor C37 at pins 7 and 8.

The detected audio is extracted from pin 9 and fed via R33 and C35 to VR40, the volume control. At the same time, a sample of the signal is coupled via R32 and C33 to an internal amplifier between pins 10 and 11.

This amplifies any noise signal (hiss) above the expected audio passband which is then rectified by D7 and used to "squelch" the audio output via control pin 12. VR39 is the squelch control.

Transistor Q8 feeds a portion of the 455-kHz signal (before limiting is applied) to

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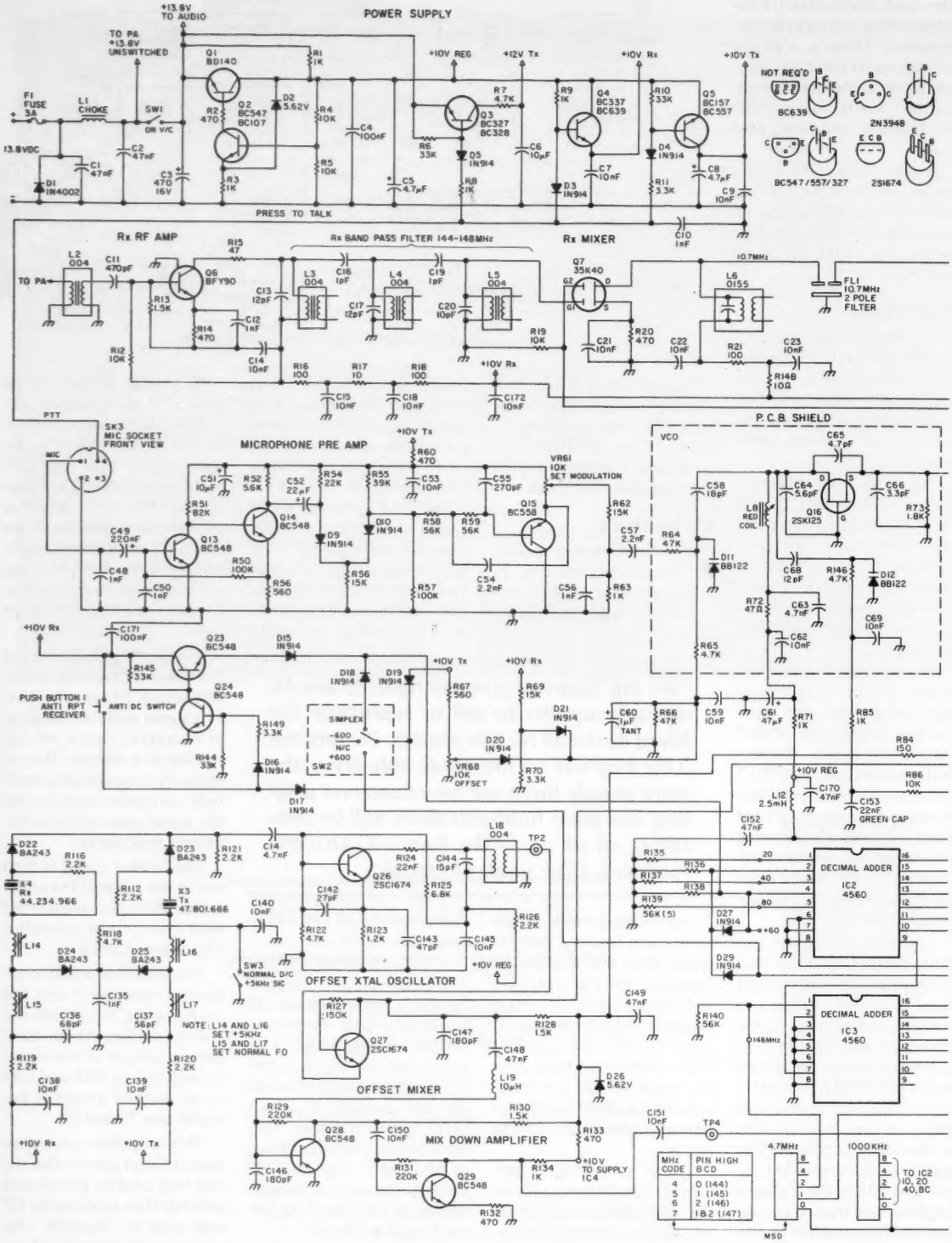
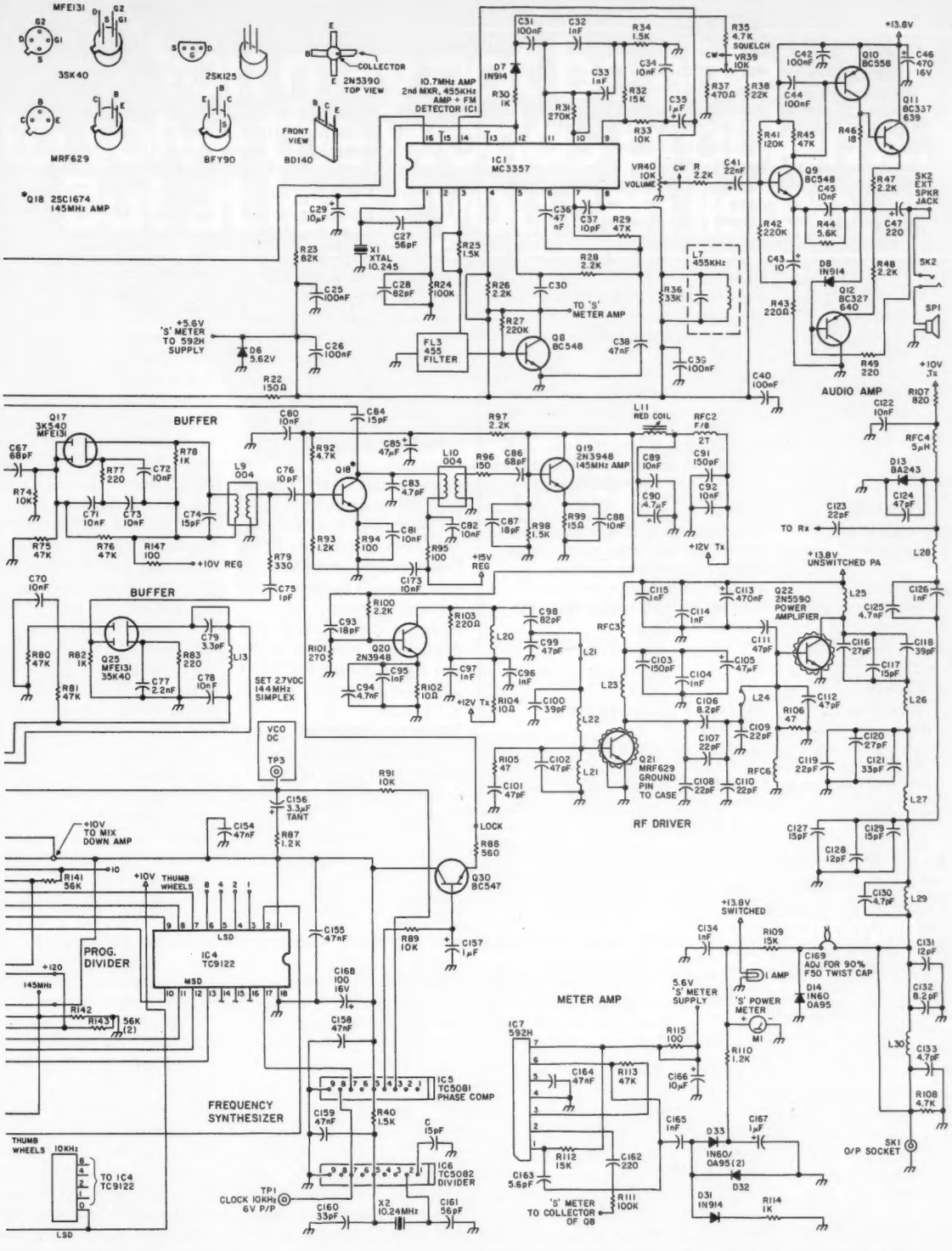


Fig. 2. Schematic diagram.

IC7, the meter amplifier. This produces an indication of signal strength when in the receive mode.

Transistors Q9 to Q12 form a conventional audio amplifier. Q9 is a straightforward common-emitter stage with negative feedback applied to the emitter via R44. Q10 is a class-A driver with bootstrapping via the output capacitor, C47. Its collector load is R49 and the speaker itself.

If the speaker is discon-



nected for any reason, the whole amplifier will latch up, which is how it manages to withstand open circuits continuously (see specs).

Q11 and Q12 form a fully complementary output pair with quiescent current set by R46 and D8. R47 and R48 are rather high in value at 2.2 Ω, which gives good bias stability, limits the power output to some extent, and gives momentary short-circuit protection.

Resistors R44 and R43 set the audio amplifier gain to around 25 (i.e., 5600/220 = 25) while C45 rolls off the response above 3 kHz.

Specifications	
General	
Frequency coverage	144 to 148 MHz (see text)
Channel spacing	10 kHz, with 5-kHz offset
Number of channels	400 @ 10 kHz, 800 @ 5 kHz (see text)
Frequency stability	within ± 10 ppm from 0 to 60°C
Modulation	frequency modulation
Temperature range	from 5 to 50°C
Duty cycle	two minutes transmit, two minutes receive
Supply voltage	12 to 15 V dc, test voltage 13.8 V dc
Polarity	negative chassis
Current drain	receive: muted, 110 mA; unmuted, 300 mA transmit: 1.9 A at 10 W; 2.5 A at 15 W
Protection	(a) 3-A in-line fuse (b) diode reverse polarity protection (D1) (c) rf power amplifier can withstand up to 5:1 vswr and open- or short-circuit conditions for at least two minutes (d) audio power amplifier can withstand open circuits continuously and momentary short circuits
Transmitter	
Power output	10 Watts nominal, 15 Watts maximum
Maximum deviation	limited to 5 kHz under normal operation; up to 10 kHz with overdrive
Distortion	less than 10% at 3-kHz deviation
Spurious emissions	less than 60 dB with respect to carrier
Harmonics	less than 60 dB
Microphone sensitivity	5 mV rms
Receiver	
Sensitivity	0.5 μV into 50 Ω for 12-dB Sinad; typically 0.4 μV
Selectivity	better than 60 dB at ± 25 kHz
Audio power	1 W at 1% THD into 8 Ω
Frequency response	6 dB/octave rolloff above 1 kHz

Transmitter Operation

The transmitter is controlled by the press-to-talk switch on the microphone and this controls the various supply rails, as mentioned before. We'll come back to that. The signal from the microphone is fed to the preamplifier (Q13 and Q14) which provides substantial gain. The amplified signal is fed via C52 to a diode limiting circuit (D9 and D10) which prevents the following stages from being overloaded.

The signal from D10 is fed to Q15, a two-pole active-filter stage with unity gain. The output of this stage is the modulating signal which is applied from trimpot VR61 to varicap diode D11 via R62, C57, and R64. D11 is in the tank circuit of the vco (Q16) and thus is able to frequency modulate the vco according to the microphone-signal voltage.

The vco is a conventional grounded-gate oscillator using an N-channel FET. It oscillates at a nominal 146 MHz (center of band) as set by L8 and C64. Varicap D12 sets the vco to the exact frequency required, as controlled by the frequency synthesizer.

The main vco output signal is taken from its source and fed to Q17 and Q18, which are transformer coupled, and thence to Q19 and Q20, which are more or less conventional common-emitter amplifier stages. Q21 and Q22, on the other hand, are class-C power-amplifier stages which operate without forward bias at their bases.

By way of explanation, in a class-C amplifier such as Q22, the collector current flows for substantially less than every alternate half cycle with the tuned circuit preventing the generation of harmonics. In effect, a class-C amplifier tank circuit can be considered as the analog of a flywheel which has a short burst of energy applied to it during every cycle. It is a highly efficient amplifier.

The output power from Q22 is coupled to the antenna filter circuit mentioned previously. The path is via L26, L27, L29, and L30 to the output socket. A measure of the transmitter output is provided as follows: Gimmick capacitor C169 (two wires twisted together) feeds a small portion of the transmitter output to D14, which rectifies the signal and applies the resultant dc to the signal meter via R109 and filter capacitor C134.

Frequency Synthesis

The method of frequency synthesis is essentially a variation on the conventional phase-locked-loop (PLL) circuit. A PLL normally is composed of a voltage-controlled oscillator (vco), a reference oscillator, a programmable frequency divider (fed by the vco), and a phase comparator which compares the frequency-divided output of the vco with the reference oscillator.

For a VHF transceiver it is usual to have three oscillators: a vco, a reference oscillator, and an offset oscillator. In this case, the vco is Q16, the reference oscillator is associated with IC6, and the offset oscillator is Q26. IC5 is the phase comparator and IC4 is the programmable divider.

Let's start by looking at IC6. This IC is a combined oscillator and divider with a division ratio of 1024. It drives crystal X2 at a frequency of 10.24 MHz, which when divided by 1024 produces a reference frequency of 10 kHz at pin 7.

IC5, the phase comparator, compares the 10-kHz reference frequency from IC6 against the 10-kHz output from the programmable frequency divider, IC4. The output at pin 3 of IC5 is the PLL error voltage, which is a series of pulses. These are filtered to produce smooth dc by R91, C156, R87, R86, and C153. This dc error voltage is then applied to D12 in the vco (Q16) to maintain control over the vco output.

As shown on the circuit, when the PLL is in the lock condition and the vco output is 144 MHz, then the error voltage at TP3 is 2.7 volts dc (after setting up.)

Where the frequency-synthesizer circuit diverges from normal PLL practice is that the programmable divider does not merely "divide down" the output of the vco. Instead, IC4 divides the difference between the vco output and the third harmonic of the offset oscillator.

The reason for this indirect procedure is that it is not possible to easily provide for programmable division directly from 144 MHz.

What happens is this. The offset oscillator, Q26, operates at 44.234966 MHz in receive mode and at 47.801666 MHz in transmit mode. The relevant crystals, X4 and X3, are switched into circuit by diode D23 or D22.

The collector output circuit of Q26 is tuned to the third harmonic of these frequencies, i.e., 132.704898 MHz and 143.404998 MHz.

Depending on whether the transceiver is in receive or transmit mode, one or the other of these offset frequencies will be subtracted from the vco output frequency by the offset mixer, Q27. The difference frequency will range from 595 kHz (e.g., 144–143.405) to 4.595 MHz (148–143.405).

It is this range of differ-

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ence frequencies which is applied to the programmable frequency divider, IC4, via Q28 and Q29.

So IC4 is programmed by the thumbwheel switches to divide the relevant difference frequency from Q27 to provide a 10-kHz output which is applied to the phase comparator, IC5.

Note, by the way, that the difference between the transmit and receive offset frequencies is 10.7 MHz, which is the required intermediate frequency.

So far, so good. But now we have to backtrack a little. There is a problem in that IC4 cannot precisely divide frequencies that are not an exact multiple of 10 kHz. Therefore, that example of 595 kHz (the lowest difference frequency) is not valid. And in fact, those offset oscillator frequencies given above are not quite correct.

Because of the provision for 5-kHz channel spacing, the offset oscillator crystals are in fact 1666 Hz too high. When the third harmonic of each crystal is considered, it will be 5 kHz high. So in normal operation, the crystals are pulled low by L14 and L15 for X4, and L16 and L17 for X3. So the normal offset transmit frequency is 47.8 MHz (143.4-MHz 3rd harmonic) and the offset receive frequency is 44.2333 MHz (3rd harmonic is 132.7 MHz).

When these offset frequencies are subtracted from the vco, the range of difference frequencies will be 600 kHz to 4.6 MHz. And note that 600 kHz is an exact multiple of 10 kHz.

When the +5-kHz facility is switched on, L15 and L17 are switched out of circuit by diodes D24 and D25 so that now the crystals do run 1666 Hz high and so the vco frequency is shifted up by 5 kHz.

Band Protection

Note that when the 10-kHz outputs of IC6 and IC4 (the programmable divider) are locked together, IC5 turns on Q30. This turns on Q18 and Q19 and thus allows the transmitter to operate. Thus the transmitter is prevented from producing signals which are outside the 144-to-148-MHz band.

But what about that +5-kHz offset we have just discussed? When that is applied, it would be possible for the vco to operate at 148.005 MHz and still produce a lock condition. The circuit design takes care of this possibility, too, since the thumbwheels are wired to only permit a maximum vco frequency of 147.99 MHz. When the 5 kHz is added, this gives a maximum vco frequency of 147.995 MHz, which is still inside the band limits.

Strictly speaking then, this means that only 399 channels are available with 10-kHz spacing and 798 channels with 5-kHz spacing (144.005 to 147.995 MHz).

±600-kHz Offset

Yet another factor has to be taken care of by the frequency-synthesizer circuitry. For repeater operation, the transmitter frequency usually has to be offset by minus 600 kHz from the receive frequency. Less often, it may have to be changed by plus 600 kHz. This condition could be met by adding more crystals to the offset oscillator circuitry, but in this circuit it has been achieved digitally.

As well as avoiding the expense of extra crystals, the digital method of offset does not require any alignment. IC2 and IC3 are digital adders. They add a code of 60 or 120 to the code applied by IC4. In the normal simplex mode, the addition of the 60 code is the standard. For −600-kHz repeater operation, this code is removed (controlled by D18 and IC2).

For +600-kHz operation, IC2 and IC3 are brought into play by D29 and D27 to add a code of 120 to IC4.

A neat advantage of this scheme is that it allows the "anti-repeater" operation whereby the receiver only can be shifted by ±600 kHz. This is achieved by the push-button in conjunction with Q23, Q24, and associated diodes. The advantage of the anti-repeater function is that it allows the operator to listen directly to his contact instead of via the repeater.

Note that when the 600-kHz offset facility is in use, the out-of-band protection circuitry does not prevent transmission outside the band limits. In this case it is up to the operator to make sure he or she does not transgress.

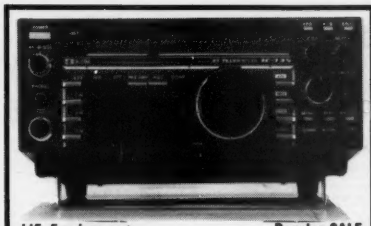
Power Supply

A +10-V regulated supply derived from Q1, Q2, and D2 supplies power to the vco, offset oscillator, frequency-synthesizer circuitry, and mix-down amplifier (Q28 and Q29). The +10-V regulated rail is also switched to various other sections of the circuit by Q4 and Q5, depending on whether the transceiver is in the receive or transmit mode.

When in the receive mode, the press-to-talk switch is open and D3, D4, and D5 cannot conduct. Therefore, Q4 supplies the +10-V receive rail. When the PTT switch is closed for transmit mode, D3 and D4 conduct, turning off Q4 and turning on Q5 to supply the +10-V transmit rail. D5 also conducts, turning on Q3 to supply the +12-V transmit rail.

The final two stages of the rf power amplifier, Q21 and Q22, are powered directly from the 13.8-V (battery) supply as is the audio amplifier. This is OK since Q21 and Q22 are normally biased off and can only operate when Q19 and Q20 are turned on by the +12-V transmit rail.

In Part II of this article, the construction and alignment of the DSE Commander will be detailed. ■



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A superb time-saving tool for the hobbyist, technician, engineer etc. This outstanding logic probe hooks onto the circuit under test for it's power (5V DC), and you can tell at a glance what the logic level is by which of the three LED's is glowing. It is easily held in one hand — so your other hand is left free! Cat Q-1272

Features:
- Adjustable threshold for DTL/TTL or CMOS cicuits
- Two modes of operation: pulse (with time stretching so you don't miss quick pulses!) and mem (holds display until cancelled.
- Low circuit loading (approx 30uA input)
- Tested to 12.5MHz

DICK SMITH'S - WHERE THE ELECTRONICS ENTHUSIAST IS #1

* Each kit requires the book for instructions

20 more fun projects to build in
Fun Way Volume 2

You've built all the projects in Fun Way 1 and now you're looking for something bigger, better and more exciting. Here it is - Fun Way 2. It takes over where Fun Way 1 finishes. There's 20 exciting new projects to try. These ones are different though. They teach you how to solder onto a professional printed circuit board and also how to use a multimeter! All of these projects have been specially chosen to be 'useful'. Just have a look and you'll agree.

$6.95

BOOK ONLY B-2605

K-2620 GIFT PACK
$17.50

Now here's a gift bargain. Over $28 worth of value for less than $20! This pack has been specially selected for quality and value. You get: a copy of Fun Way Volume 2; a quality Dick Smith soldering iron; a pack of solder; a 9 volt battery PLUS our most popular kit - a wireless microphone.

Flasher
Make it as the latest in electronic jewellery, or a burglar warning light, etc. The choice is yours and it's fun!
Cat K-2621 **$2.95**

Ding Dong Doorbell
Yes, it actually sounds like a great old fashioned doorbell. But it's electronic and you can build it!
Cat K-2622 **$4.50**

Morse Code Trainer
You can turn this audible alarm into just about anything requiring sound. Even for Morse code - and it's fun to learn!
Cat K-2623 **$4.50**

Universal Timer
Eggs too hard? Time them with this great little timer. It really works - set it for a few seconds to 15 mins.
Cat K-2624 **$5.50**

Electronic Dice
Just as much fun using it as it is building it! And it is really random - no cheating with this one!
Cat K-2625 **$4.95**

Mono Organ
Snazzy little circuit uses the back of the PCB as the keyboard! Play a tune - it's easy.
Cat K-2626 **$7.95**

Pocket Transistor Radio
Build this set and learn about the fundamentals of radio. And then you'll have fun using it too!
Cat K-2627 **$7.95**

Touch Switch
Ever wondered how lift buttons work? Build this kit yourself and you'll be able to work it out.
Cat K-2628 **$5.50**

Mosquito Repeller
Do mozzie repellers really work? Build this one and find out. You won't hear it - but the mozzies will!
Cat K-2629 **$4.95**

Intercom Amplifier
Use it to make the intercom (project 18) or use as a general purpose amplifier. Really handy, good sound output too.
Cat K-2630 **$6.50**

Wireless Mic
Just like the 'bugs' used in spy movies! Transmits to any standard FM radio in another room or next door, etc. Hear it all!
Cat K-2631 **$8.50**

Light Activated Switch
Useful in many security applications around the home etc. You could even use it to trigger a burglar alarm.
Cat K-2632 **$5.50**

Metal/Pipe Locator
Extremely handy for locating pipes, wires, etc. in walls before drilling holes. Surprisingly simple for such an effective circuit.
Cat K-2633 **$6.50**

Sound Activated Switch
Picks up sound and triggers. Use as a telephone bell extender or in security applications.
Cat K-2634 **$6.50**

Home/Car Alarm
Very practical! You could use this alarm to protect your home and property! Uses any of the normal alarm triggering devices.
Cat K-2635 **$8.50**

Electronic Siren
Just what you need with the alarm! Also makes a great sound effects circuits - and Fun Way 2 tells you what to do!
Cat K-2636 **$4.95**

LED Level Display
Hook it up to your stereo and it can warn you of dangerous overloads. Looks pretty nifty. The LED's light up in time to the music!
Cat K-2637 **$8.95**

Intercom Unit
Build you own intercom & use it around the home. Practical, simple to build with the intercom amplifier (Project 10).
Cat K-2638 **$8.95**

Led Counter Module
An introduction to the world of IC's. This useful gadget can be used for counting applications - or just for fun!
Cat K-2639 **$7.95**

Short Wave Receiver
Tune in to short wave stations or emergency services and amateurs etc. Easy and fun to build.
Cat K-2640 **$6.95**

See Vol. 1 for full instructions and explanations.

Fun Way 1

Fun Way One Project Kit 1-10

Enables you to build any of the first ten projects in Fun Way One. And because the components are not soldered, they are all re-usable so you can build any other of the first ten projects too.
Cat K-2600 **$7.25**

- Continuity Indicator
- Transistor Tester
- Water Indicator
- Light/Dark Indicator
- The Flasher
- An electronic Siren
- Dog and cat communicator
- A decision maker
- Morse code communicator
- Music Maker

NO SOLDERING REQUIRED

Fun Way One Project Kit 11-20

Contains the more specialised components required to complete the last ten projects (11-20) in Fun Way One.
Note: you will also need the 1-10 kit to build the projects.
Cat K-2610 **$7.90**

- Sound Effects Generator
- A Crystal Set
- One Transistor Amplifier
- Beer Powered Radio
- Two Transistor Amplifier
- World's Simplest Transmitter
- Voice Transmitter
- CB Radio Receiver
- Amateur Radio Receiver
- Radio Booster Amplifier

OVER 500,000 FUN WAY KITS SOLD!

Fun Way Volume 3

ONLY **$6.95**

Light and Sound
Another multi-talented project. Sound effects, flashing lights - continuity tester. Morse code oscillator . . . it's got the lot!
Cat K-2665 **$8.95**

Two Up
Australia's national game - now done electronically because the original King George pennies are hard to get!
Cat K-2661 **$9.95**

Cricket
Whaaaa! Hide it in a dark room and it starts chirping. Turn the light on and it stops. It's infuriating!
Cat K-2683 **$9.95**

Mini Stereo Amp
Just the shot for Walkie stereo - now you can listen to it in your bedroom through speakers! Or make yourself a PA amplifier.
Cat K-2667 **$14.95**

Minder
A multipurpose project for the car. Lights on warning, door opening warning plus a pseudo burglar alarm.
Cat K-2660 **$7.95**

Mini Colour Organ
Like a disco - but battery operated so it's safe! Connect to your radio, etc. for a LED lightshow.
Cat K-2664 **$12.95**

Combination Time Lock Switch
Make it into a game . . . or use it as a real alarm component. It's that good! Just try getting into this one!
Cat K-2666 **$12.95**

Lil Pokey
It's a barrel of fun to play. And you don't risk losing your shirt like the real thing.
Cat K-2662 **$19.95**

Binary Bingo
A game of skill and reaction time - and a valuable teaching aid! It might sound pretty simple to play - but try it and see!
Cat K-2668 **$19.95**

Mini Synth
Wow! A real musical synthesiser, with decay, frequency doubling & halving, tremolo . . . unique circuit uses YOU as the note generator!
Cat K-2669 **$19.95**

When you've worked your way through Volumes 1 & 2 you're ready for the more complex projects described in full detail in this book. Then you could be ready for a job in electronics.
Cat B-2610

* Each kit requires the book for instructions

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MASSIVE POWER

NEW

FANTASTIC TEST BENCH POWER SUPPLY

$129.95

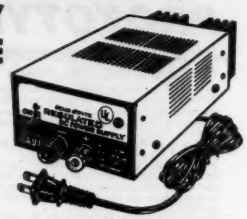
This beauty will supply up to 20 Amps all day to your test bench or amateur radio station. Ideal for 50 and 75 watt, 2 meter ham band linear amplifiers. It is a precision regulated DC supply with the added features of:

- Electronic overload protection with instant automatic reset
- Fuse protected
- Neon lighted on/off rocker switch

Cat. M-9547 Size: 11.5" x 7.75 x 4.375 Weight: 16lb

Be served by an enthusiast like you at DSE

HEAVY DUTY SOLID-STATE 13.8V/ 4A Peak



- Housed in high-impact plastic case with massive ventilation for long service.
- Rubber feet to keep stable, eliminate scratching.

Regulated D.C. Power Supply, 13.8 VDC, 3/5 Amp. For home, lab, service bench, CB, stereo and auto radios, this is an extremely versatile unit. You'll wonder how you managed without it!

Input is 117VAC 60Hz 100W, and the output is fully regulated low ripple 13.8VDC to supply, 3 Amps continuous and up to 5 amps surge. The unit is fuse and double-short circuit protected with on/off switch and pilot light.

Cat. M-9545

$19.95

Dick Smith Electronics – your one stop electronics shop

Ni-Cad charging Cabinet

$11.95

10 up $10.50 ea

Can't charge NiCads inside the device? No problems: this incredibly versatile charging cabinet suits virtually all sizes and types of NiCad cell. Has a test meter to indicate charge and 5 LED indicators to show batteries are connected. Fully approved, complete with plug-pack. Cat M-9519

Hole Punch Set

Ideal chassis basher tool, in fact a necessary tool for anyone who needs a large hole cut through metal. It's easy to use, needs no filing and it will cut a hole without distortion. The complete set includes a 12mm tapered reamer, tommy bar, 5 punches - 18mm, 18mm, 20mm, 25mm, and 30mm. Individual chassis punches bought separately would cost a lot more than the price being charged for the whole set! Will handle steel to 22 gauge and aluminium to 16 gauge. Cat T-4900

$19.95

LATEST TECHNOLOGY

$149

Cat Z-4845

High output Solar Panel

HUGE 1 AMP OUTPUT

These solar panels utilize high technology actually designed for satellites that generate on average 20% more than the normal .45 volt cell. High density packaging gives really high output. Encapsulated aluminium substrate makes the panels temperature proof, shock proof and weather proof.

Ideal for all sorts of uses to boat owners, amateur operators, technicians or anyone else that has had to keep a 12V battery charged in an out of the way place.

1 Amp Output (10 volts) or 20V @ 500 MA Cat. Z-4845 10 up $140.00 ea $149.00

500 MA Output (10 volts) or 20V @ 250 MA Cat. Z-4844 10 up $99.00 ea $109.00

Both panels supplied with specification ideas and wiring harness, cigarette lighter plug, lugs and suction cup with hook to suspend your solar panel.

MADE IN U.S.A.

Our worldwide bulk buying power makes our prices look crazy.

1.2 & 2.2GHz Frequency Counters

EXCLUSIVE

We have been fortunate enough to make this exclusive direct buy. Compare the price of this state-of-the-art unit with older models.

● Size: 8.5" x 7.5" x 3"

There are two to models to choose from:

MODEL 21 – 1GHz to 1GHz

MODEL 22 – 1GHz to 2.2GHz

MODEL 21 Cat Q-1315 ONLY $249.00

MODEL 22 Cat Q-1318 ONLY $499.00

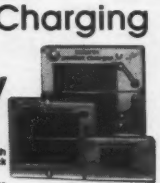
Compare with much more expensive models

DICK SMITH'S – WHERE THE ELECTRONICS ENTHUSIAST IS #1

17 years reliable mail order service – as close as your mailbox

Dick Smith Electronics – as close as your mailbox

FREE Battery Charging with the Solar Battery Chargers



Charge Batteries with Free Solar Power through Space Age Technology available from Dick Smith Electronics

Here is a convenient and safe way to revitalize worn down batteries. Pocket chargers start saving money the first time they are used. These pocket chargers are completely self contained, compact and easy to use.

Button Cell Charger
Brings new life to your button cells.
M-9504 $19.95

4 x AA Charger
Can charge from 2 to 4 'AA' ni-cads complete with suction cup and hook for easy suspension.
M-9502 $24.95

2 x AA, C, or D Charger
This one comes complete with C and AA adapter as well as suction cup and hook for easy suspension.
M-9500 $29.95

NEW

Solder Stand with magnifier!

The helping hand when you need it most when you have a 'hot stick' in your hand! Heavy die-cast base, solder stand, clips for holding PCB, etc – plus a unique magnifying lens for those close assembly jobs. Cat T-5710

BEAT THIS PRICE $6.95

We carry a huge range of electros, polyester, tantalums, ceramics and styros. Please ask when ordering and we will probably be able to supply your needs.

DSE 2840

Primary: 117V, 60Hz
Secondary Voltage: 4.5-4.5V
Secondary Current: 150mA
Terminations: Flying Leads
Cat M-2840

$2.50

10 up $2.25 ea

DSE 2851

Primary: 117V, 60Hz
Secondary Voltage: 6.3-0-6.3V
Secondary Current: 150mA
Terminations: Flying Leads
Cat M-2851

$2.50

NEW

DSE 2155

Primary: 117V, 60Hz
Secondary Voltage: 6.3, 7.5, 8.5, 9.5, 12 & 15V
Secondary Current: 1 Amp
Terminations: Flying Leads
Cat M-2155
10 up $5.50 ea

$5.95

DSE 6672

Primary: 117V, AC
Tapped Secondary Voltages: 15, 17.5, 20, 24 27.5, 30 volts
Secondary Current: 1 Amp
Termination: Solder Lugs
Cat M-6672

$7.95

10 up $6.95 ea

Magazine File

A magazine binder, ideal for any magazines that cover 12 issues in one year. Hard spine with metal rods for placement of the magazines. Cat B-4045

VALUE $4.95

ILLUMINATED PUSH BUTTON

Lamp 12V @ 55mA

As used in car burglar alarms, control panels, etc. Alternate action switch with inbuilt 12V globe. Square finish body, round mounting hole.

Features:
125V AC 3A
Body size .58" x .58"
Mounting hole .47"
Clearance 1.57"
Cat S-1520
10 or more $4.50 each

$4.90

IRRADIATED HEAT Shrinkable Electrical Tape

$3.75 Cat N-1365

For RF connectors, computer connectors or any connector or cable splice that has to be water proofed or insulated. When heated (a heat gun will serve excellently) there will be a 30% tightening around the object. Secondly the inner lines will soften and flow into the tape wrappings. Tensile strength 1200 PSI. Dielectric strength 9kV min., Color Black, 10' length.

Giant Handbook of Electrical Circuits

Raymond A Collins-880 pages

Giant isn't the word: its a whopping 880 pages! With 60 chapters covering everything from crystal sets to computer circuitry, you're sure to find what you want here!

Cat B-1780 $19.95

IC EXTRACTION TOOL

$2.95

Cat. T-4650

The perfect way to remove IC's without damage. Works with all DIL packs, no bent pins and no static damage! Operates like a pair of tweezers - with hooks!

Satisfaction Guaranteed or your money back.

Signal Injector

One of the handiest devices to have in your tool box. Check out both audio and RF circuits (harmonics extend to many MHz) simply and easily. Often the quickest method of fault finding (and one of the cheapest!) Self contained, with probe and earth clip. Cat Q-1270

$9.95

Battery Operated

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STATIC RAMS

DEVICE	Cat No	Description	PINS	Speed	Price	10 up ea
2102	Z-9302	1024 x 1	16	350ns	99¢	89¢
2114	Z-9306	1024 x 4	18	450ns	1.05	95¢
HM6116P-4	Z-9308	2048 x 8/16K CMOS	24	200ns	3.49	2.95

DYNAMIC RAMS

4116	Z-9310	16,384 x 1/MMS290N-3	16	200ns	1.00	90¢
4164	Z-9312	65,536 x 1	16	150ns	3.95	3.50
41256	Z-9314	262,144 x 1	16	150ns	10.95	9.95

EPROMS

2516	Z-9207	2048 x 8 16K/2716	24	450ns	4.95	4.75
2532	Z-9208	4096 x 8 32K/2732	24	450ns	4.95	4.50
2732A	Z-9209	4096 x 8 32K (21V) Intel	24	150ns	4.95	4.50

8000 SERIES

P8085-AH	Z-9385	CPU 8 bit N-Channel	40	5MHz	6.50	5.95
8086	Z-9386	CPU 16 bit	40	5MHz	19.95	17.95
P-8088	Z-9388	CPU 16 bit/8 bit Data bus	40		14.95	12.95
P-8235-5	Z9453	Prog Internal Timer			7.50	6.50
P8255A	Z-9455	Prog Peripheral	24		4.95	4.50
P8284A	Z-9484	Clock Generator and Driver	40		5.49	4.50
D8288	Z-9488	Bus Controller 8086/88	18		13.95	12.95
			20			

6500/6800 SERIES

P6502	Z-9502	MPU with clock	40	1MHz	5.95	5.50
6845	Z-9545	CRT controller			12.95	11.95
6850	Z-9550	Asynchronous Comm Adaptor			3.75	3.55

3½ digit LCD driver Cat Z-6300 $9.95 ea 10 up $9.00 ea

74HC

Type No.	Cat No.	Price Ea	Price 10 up.
74HC00	Z-5800	.55	.50
74HC02	Z-5802	.55	.50
74HC04	Z-5804	.55	.50
74HC08	Z-5808	.55	.50
74HC11N	Z-5811	.55	.50
74HC14	Z-5814	.55	.50
74HC27	Z-5827	.55	.50
74HC30	Z-5830	.55	.50
74HC32	Z-5832	.60	.55
74HC74	Z-5874	.70	.65
74HC76	Z-5876	.70	.65
74HC85	Z-5885	$1.30	$1.20
74HC86	Z-5886	.55	.50
74HC123	Z-5910	$2.20	$2.00
74HC138	Z-5915	.95	.90
74HC139	Z-5920	.95	.90
74HC157	Z-5925	.95	.90
74HC165	Z-5930	$1.90	$1.70
74HC174	Z-5935	.99	.95
74HC221	Z-5940	$2.60	$2.40
74HC240	Z-5945	$1.95	$1.85
74HC244	Z-5950	$1.75	$1.65
74HC245	Z-5955	$1.85	$1.75
74HC367	Z-5960	.90	.80
74HC373	Z-5965	$2.25	$2.05

Sorry about no descriptions on some products - we ran out of room. This is only a small sample of our IC range – our new catalog will list the full range - with descriptions.

IC SOCKETS

Why endanger valuable IC's by soldering them directly into circuit? Take the safe approach: use an IC socket! It makes service and repair of your project much, much easier too. There's an IC socket to suit all common IC's.

THOUSANDS SOLD

VERY SENSIBLE!

8 pin mini DIL socket 15¢ Cat P-4080 10 up 13¢ ea

14 pin DIL socket 14¢ Cat P-4140 10 up 14¢ ea

16 pin DIL socket 18¢ Cat P-4160 10 up 16¢ ea

The semi's listed here are only a tiny fraction of our huge range – please enquire about types and prices.

SCR's

Economy Plastic Pack

Type	Vdrm	IT(A) rms	Use	Cat No	Price Ea	Price 10 up
				Z-4310	.44	.40
			Small Current Sensitive Gate	Z-4315	.29	.25
			Sensitive Gate	Z-4320	.80	.75
			AC Switch	Z-4332	.95	.90
C103B	200	0.8				
C106Y1	30	4				
C106D	400	4				
C122E	500	8				
(ST151, TIC126S)						

RECTIFIER DIODES

Type No	Cat No	Price Ea	Price 10 up	PIV	If Amp	Use
	Z-3202	.06	.05	100	1	General Purpose
IN4002	Z-3204	.10	.08	400	1	General Purpose
IN4004	Z-3207	.12	.10	1000	1	General Purpose
IN4007	Z-3222	.30	.25	400	3	General Purpose
IN5404	Z-3228	.30	.25	1000	3	General Purpose
IN5408						

SILICON SMALL SIGNAL DIODE

		Price Ea	Price 10 up
IN914	Z-3120	.05	.04

LIQUID CRYSTAL DISPLAY

			Price Ea	Price 10 up
LCD4.5	0.4"	4½ digit liquid crystal Z-4175	$9.95	$9.00

LINEAR IC's

Type No.	Cat No.	Description	Price Ea	Price 10up ea
TL555CP	Z-6144	CMOS timer	.69	.65
NE/DS555	Z-6145	Universal timer	.35	.30
NE556	Z-6146	Dual timer	.79	.75

Dick Smith Light Emitting Diodes

Type No	Colour	Size	Cat No.	Price EA	Price 10 up	If @ 20 mA	Vf @ Intensity @ 20mA	Notes
			Z-4070	1.00	.90	40	2.5	3.0mCd Dual
LT2462-52	Rd/Gr.	0.2" diam	Z-4075	.95		50	1.7	200mCd High Intensity
E5BR5501	Red	0.2" diam	Z-4077	.20	.10	40	2.1	3.5mCd Premium Quality
TL4211	Red	0.12" diam	Z-4079	.35	.30	40	2.1	5.0mCd Premium Quality
TL4231	Green	0.12" diam	Z-4081	.30	.25	40	2.0	7.0mCd Premium Quality
TL4251	Yellow	0.12" diam	Z-4083	.30	.25	40	2.1	4.0mCd Premium Quality
TL4291	Orange	0.2" diam	Z-4085	.20	.10	40	2.1	6.0mCd Premium Quality
TL4219	Red	0.2" diam	Z-4067	.22	.18	40	2.0	6.0mCd Premium Quality
TL4239	Green	0.2" diam	Z-4069	.30	.25	40	2.1	9.0mCd Rect. Prem. Qual.
TL4233	Yellow	0.2" diam	Z-4091	.30	.25	40	2.1	1.2mCd Rect. Prem. Qual.
TL4253	Orange	0.2" diam	Z-4093	.30	.25	40	2.1	1.2mCd Rect. Prem. Qual.
TL4293	Red	0.08 x 0.2"	Z-4095	.30	.25	40	2.1	1.2mCd Rect. Prem. Qual.
TL32155	Green	0.08 x 0.2"	Z-4097					
TL32555	Yellow	0.08 x 0.2"						

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Out of the Inner Circle

240 pages
Bill Landreth

INNER CIRCLE

Well I tell you, if you never buy another book on computers, buy this one written by "the Cracker". The 19 year old computer whiz kid apprehended by the F.B.I. and now author of the eye-opening inside story of America's electronic hacking culture.This book will give you heaps of information about "computer hackers" and the art of "hacking". What's more, it even lets you know the secret to keeping potential hackers out of your system. A fantastic hacker's guide to computer security.

Cat B-2370

$9.95

Compact Disc Library System

These very attractive modules are made of high-impact, tinted plastic that stack vertically or horizontally with a very positive interlocking system so that they will not slip about or fall over. Your discs stack neatly in individual shelves. Two modules in each dual shelves system hold up to 24 discs.

Cat C-3830

$12.95

Flashing Strobe

$14.95

10 up $13.95 ea

SUPER VALUE

A new idea . . . and a beauty! A bright blue flashing 'strobe' lamp (like on the top of you-know-what cars!) which demands absolute attention. Placed outside the property (say under the eaves of the house) it will instantly show neighbours, Police, etc where the alarm is occuring (it's not always easy to tell from which direction a siren or bell is coming!) Operates from 12 volts: use in conjunction with virtually any alarm controller via 'relay' output.

Cat L-9000

Lost your keys again?? JUST WHISTLE!

That's right, with one of these little beauties next time you misplace your keys just whistle and it will beep right back at you. A great conversation starter too!

Cat Y-1070

$12.95

10 up $11.95 ea

Connector Packs

How's this for a last minute bargain? Connector packs in either 2, 3, 4, 5, or 8 way. All come with nylon connector housing and 2.38mm tin plated brass pin terminals for long life and reliability with no loose ends!

As used in most cars – ideal replacements

	Price 10 up	Ea
Cat P-5102	$1.20	$1.10 2-way
Cat P-5103	$1.30	$1.20 3-way
Cat P-5105	$1.40	$1.30 4-way
Cat P-5106	$1.60	$1.50 5-way
Cat P-5112	$2.20	$2.00 2-way

IT'S AMAZING... BUT TRUE!

WOW! ONLY $1.00 ea.

12V DC MOTORS 10 up 80¢ ea

Cat J-0010

Grab 'em while they last!

These little beauties are used in car cassette players so they are robust and spin freely. They have plenty of torque so you can use them for all sorts of projects.

The 3 flanges on most of the motors makes it extremely easy for mounting.

VALUE

Opening soon in San Jose

Resistance Substitution Wheel

Cat Q-1410

$5.95

Convenient size with large, easy to read value selection that enables you to select values from 5 ohms to 1 M ohm in 36 steps by using most common divisions. Complete with leads and insulated crocodile clips.

Easy to build • Very useful

SOUNDBENDER

With this great little kit you can sound like a Dalek, a Darth Vader, a Cylon, or any one of a dozen robotic spin-offs! Is Used for special effects on electric guitars and other musical equipment.

Cat K-3509★

$19.95

TOP QUALITY

QUALITY NI-CAD Rechargeable Batteries

From $1.49 ea (10 up price of AA)

Amazing VALUE!

Ni-Cads work out much cheaper in the long run, especially if you buy them from Dick Smith Electronics.

Type	Cat No.	Price each
AA	S-3300	1.99
AAA	S-3305	1.95
C	S-3301	2.95
D	S-3303	2.95

CAN'T READ OUR AD?

$6.95

$2 off for any customer who has difficulty reading this ad.

2½" double glass lens, stamp/coin viewer – excellent for inspecting hairline cracks in PCB's.

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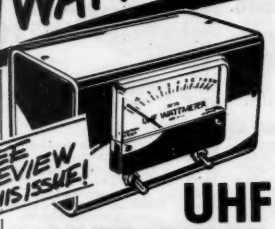

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Like many others who like to keep their hands busy and who like the smell of solder, I also pass my time by building simple receivers[1] and QRP transmitters. I am always worried that the output filter of the QRP transmitter is not working well and that I put out too much second-harmonic power. It is no use listening to the second harmonic on the station receiver—it always sounds strong and no real idea can be formed of the strength in relation to the primary emission.

Of course, like most other hams, I don't own a spectrum analyzer to determine the harmonic output, but through the years I developed first a simple relative method and then a somewhat more sophisticated method of determining second-harmonic power. Of course, there are higher harmonics also, but in this discussion I shall stick to the second harmonic. In this article, I concentrate on 40m power from an 80m QRP transmitter.

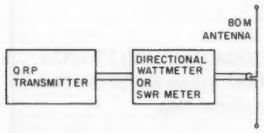

Fig. 1. QRP transmitter hooked through directional wattmeter or swr meter to 80m antenna.

Simple Relative Method

I know that on my 80m antenna there is a frequency spot where the swr is exactly 1:1. So, when I finish building a QRP transmitter, I tune it to this frequency and hook it through a directional wattmeter (a simple swr meter will also do) to the 80m antenna (see Fig. 1). As the swr is 1:1 on 80m, there will be no reflected power on 80m. All the reflected power is thus on 40m or higher frequencies.

All that I then do is to tune the output stage and filter of the QRP transmitter so that this reflected power is at a minimum. Then I check the forward power again to see if it hasn't dropped too much. After this I am pretty certain that almost all of the power going out is on 80m.

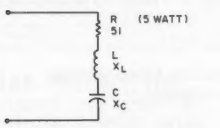

Fig. 2. Special dummy load.

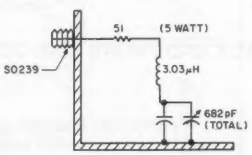

Fig. 3. Construction of special dummy load.

More Sophisticated Method

In the first-mentioned method, no idea can be formed of the ratio of 80m to 40m power, but it can be calculated if the swr on 40m on the 80m antenna is known exactly. (Somehow it doesn't appeal to me to put all these signals on the air for testing purposes only, even if I announce my callsign every time.) So I started thinking of a type of dummy load which has an swr equaling one on 80m and a much higher (but known) swr on 40m. Such a dummy load is shown in Fig. 2.

In Fig. 2, the 51-Ohm resistance, R, has more or less the same value as the impedance of 52-Ohm coaxial cable (Z_0). On 80m, $X_L = X_C$ and thus cancel out where X_L = inductive reactance of inductor L (Ohm) and X_C = capacitance reactance of capacitor C (Ohm).

On 40m, $X_L \neq X_C$, which causes a certain swr on 40m. See box for theoretical calculations.

In practice, we choose R = Z_0 and for 80: $X_L = X_C$. If these values are put in Equation 4, the swr = 1, as it should. If for 40m X_L is not equal to X_C, the swr is a value greater than one. We can now either choose a value for the swr and calculate $X_L - X_C$ or choose a value for $X_L - X_C$ and calculate the swr on 40m.

I chose the latter route and put $X_{L40} - X_{C40} = 100$, where the subscript 40 means 40m and later on the subscript 80 will mean 80m. Put in Equation 4, we get $swr_{40} = 5.83$.

So, if we now know the swr on 40m how can we apply it to find E_f on 40? From Equation 3 we can write Equation 5: $E_{f40} = [E_{r40}(swr_{40} + 1)^2]/(swr_{40} - 1)^2$. We also know that as $swr_{80} = 1$, there is no reflected power on 80m. So all the reflected power is due to 40m (or higher) harmonics. Total forward power E_{ft} is equal to $E_{f80} + E_{f40}$. For the measurement and calculation of E_{f40}/E_{f80}, we go about as follows:

Put the directional wattmeter in the line between the transmitter and the special dummy load. Read the forward power, which is $E_{ft} = E_{f80} + E_{f40}$. Read the reflected power, which is equal to E_{r40}. From the above equation, calculate E_{f40}. Then $E_{f80} = E_{ft} - E_{f40}$, and the ratio E_{f80} to E_{f40} can be calculated. An example later on will make it clearer.

To calculate values of L and C in Fig. 2, we can write the following equations: $X_{L40} - X_{C40} = 100$ (chosen value); $X_{L80} - X_{C80} = 0$. Thus, for 40m:
$2\pi \times 7 \times 10^6 \times L \times 10^{-6} - 1/(2\pi \times 7 \times 10 \times C \times 10^{-12}) = 100$, and for 80m:

$2\pi \times 3.5 \times 10^6 \times L \times 10^{-6} - 1/(2\pi \times 3.5 \times 10 \times C \times 10^{-12}) = 0$.

Here we have two equations with two unknowns, and from simple arithmetic we get L = 3.03 microhenrys (μH), and C = 682 picofarads (pF).

(By the way, we don't need the actual X values, but here they are as a point of interest: $X_{L80} = X_{C80} = 66.6$ Ohms, $X_{L40} = 133.3$ Ohms, and $X_{C40} = 33.3$ Ohms.)

Construction

Construction is very, very simple. Using the well known formula for coils (in all handbooks), I wound a coil, L, with value 3.03 μH. For the capacitor, C, I put 470 μF in parallel with a variable, connected it to my capacitance meter, and turned the variable until total capacitance was 682 pF. If you don't have a capacitance meter, just put a few capacitors in parallel to get 682 pF. For resistor R use 51 Ohms. (47 or 56 Ohms will also do; 5 Watts; carbon.) Put the items together as in Fig. 3.

To test the contraption, I tuned my station transceiver to as low an output as possible. I switched to 3.5 MHz and connected it to the special dummy load through the directional wattmeter/swr meter. The swr was exactly 1.0. Then I tuned to 7 MHz, and lo and behold, the swr read 6.0, very near to the theoretical value of 5.83. I began to get the feeling that this thing was going to work!

Application

After the test, I removed the station transceiver and hooked on my latest 80m QRP transmitter. The directional wattmeter read: forward power, 22 Watts. Thus, $E_{ft} = E_{f80} + E_{f40} = 22$ Watts. I switched to reflected power, and the meter read 1 Watt.

Thus, $E_{f40} = 1$ Watt; from Equation 5: $E_{f40} = [1 \times (5.83 + 1)^2]/(5.83 - 1)^2 = 2.0$ Watts.

THEORY

Here are some equations for the calculation of swr—see reference 2.

(1) Swr = $(1 + p)/(1 - p)$, where p = reflection coefficient; and

(2) $p = \sqrt{E_r}/\sqrt{E_f}$, where E_f = forward power (Watt) and E_r = reflected power (Watt).

(3) Thus swr = $(\sqrt{E_f} + \sqrt{E_r})/(\sqrt{E_f} - \sqrt{E_r})$.

In terms of impedances, the complete equation for swr is

(4) Swr = $(\sqrt{(R + Z)^2 + (X_L - X_C)^2} + \sqrt{(R - Z_0)^2 + (X_L - X_C)^2})$ divided by $(\sqrt{(R + Z_0)^2 + (X_L - X_C)^2} - \sqrt{(R - Z_0)^2 + (X_L - X_C)^2})$.

(5) $E_{f40} = [E_{r40}(swr_{40} + 1)^2]/(swr_{40} - 1)^2$.

Thus, $E_{f80} = E_{ft} - E_{f40} = 22 - 2 = 20$ Watts; $E_{f80}/E_{f40} = 20/2 = 10 = 10$ dB.

Thus, the 40m signal is only 10 dB lower than the 80m signal. This is not good enough, and I now know I'll have to work again on the output stage and low-pass filter of my QRP transmitter.

Conclusion

I have described a method and simple device with which one can ascertain the second harmonic power of a home-built transmitter. I am sure that with a little thinking it can be extended to measure the higher harmonics, also. Is there an ingenious reader who will attempt this, without nearing the complexities of a real spectrum analyzer? ■

References

1 "Direct Conversion Lives," Mike van der Westhuizen ZS6UP, *73 Magazine*, November, 1980.

2 *ARRL Antenna Book*, American Radio Relay League, Newington, Connecticut.

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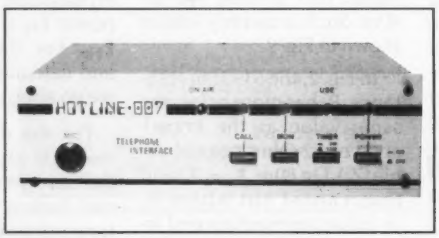

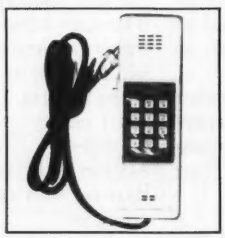

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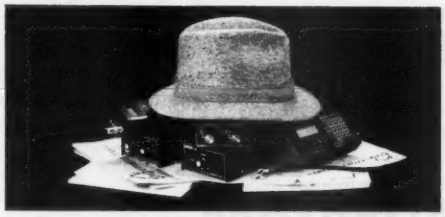

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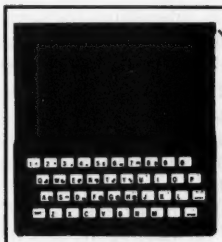

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Hams with TVI problems often learn the hard way how poor metal connections can generate harmonics. Two conductors making partial contact, in gutters for example, can rectify and re-radiate as harmonics part of the signal from a nearby transmitter. What few newer hams realize is that the same phenomenon was crucial to the operation of one of the cheapest receivers ever designed: the Foxhole radio.

Photos by W1GSL

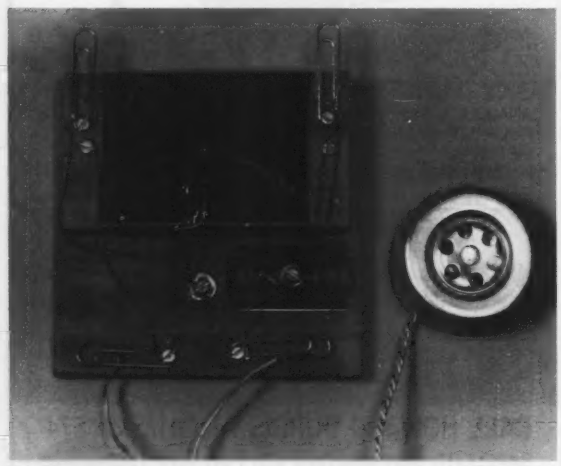

Photo A. A close replica of a set W8EFW described in 1945, this Foxhole radio can be built for pennies and works amazingly well. The razor blade is the diode. The earphone was borrowed from a telephone.

The phrase "hurry up and wait" probably predates World War II, but its meaning was certainly driven home then to thousands of hams. Often serving long tours of duty in forgettable places, ham GIs gave top priority to receiving news and entertainment from the nearby Armed Forces Radio Station. Of course, in those days radios used tubes, so the bulk and power requirements of typical receivers limited their availability. This was especially true in forward locations where the Army had more important services to provide—things like food and ammunition.

So some genius, and we can only hope he was a ham, invented the Foxhole radio. Made from commonly available components, its chief distinguishing feature was the use of a razor blade for the detector diode. A flat coil of enameled wire and a headset (probably "borrowed" from a field telephone) completed the circuit. While not an outstanding performer, the radio was compact, obtainable, and best of all—it worked! Copies were built and used all over the world.

The original design has several interesting features in addition to the razor-blade detector. Note the absence of a tuning capacitor in Fig. 1(a). The sliding contact on the coil doesn't tune stations so much as it adjusts the match between the antenna and its load. There might be some tuning action if the antenna looks capacitive, but selectivity is sure to be poor. My guess is that it didn't matter because there was probably only one station to listen to anyway.

Puzzled about the wide, flat coil form shown in the photographs? Everyone knows a good efficient inductor is wound as a cylinder no more than two diameters long. The flat coil may be an electrical compromise, but it sure is a lot easier to pack in a knapsack, put in a pocket, or hide in a POW camp.

All in all, the Foxhole receiver is real ham-radio stuff. You scrounge the parts, put them together as

best you can, and the result works!

Building the Foxhole radio today is as easy as it was in WWII. The set shown in Photo A is the real thing—a close copy of the receiver described by W8EFW in the *QST* "Hints and Kinks" column for September, 1945. To improve performance, I also built the several accessories shown in Photo B. The biggest gain came from using a capacitor to resonate the coil. In keeping with the spirit of the project, even that component was homemade—with plates snipped from the side of an old tin can.

A Razor-Sharp Detector

The razor-blade detector is the most interesting part of the receiver. To build it, you first need a Gillette Super Blue Blade. Forget about using anything made of platinum or coated with Teflon™. To simulate wartime conditions, I used my blade for its intended purpose until it hurt—about three weeks. That may not be necessary, but I wanted to do things right and my wife wouldn't let me dig a foxhole in the backyard. Compromises are sometimes unavoidable.

I clamped the used blade to the baseplate with a short woodscrew (W8EFW recommended thumb or carpet tacks). The same mounting screw clamps the contact wire to the blade, so I scraped away some of the bluing to ensure a good contact.

The rectifier contact point is made from a 1" piece of pencil lead. Start by sharpening a pencil, then carefully carve away the wood at the tip. Break off the sharpened length of lead and tightly wrap its blunted end with 8 or 9 turns of fairly stiff wire. Leave a 1" or 2" pigtail of wire to clamp under the "phone jack" terminal screw when you mount the rectifier.

In operation, the point of the lead is moved over the surface of the razor blade until a sensitive spot is found. When that happens, the radio starts to work and the lead is carefully released so that its mounting wire holds it in the correct position. I found rectification was best when the point contact was resting on one of the silver letters etched into the blade. Of course, it goes without saying that the blade is thoroughly cleared of soap or oil before rectification is attempted. This is a crude system and a little tricky to adjust, but once set up, it works surprisingly well.

Scrap Wood Chassis

Construction of the rest of the radio is shown pretty clearly in the photographs. The baseplate is a 4" by 4" square of 3/8" or 1/4" wood. The coil is about 175 turns of #26 enameled wire wound on another scrap of the same wood, this one 2" by 4". Any wire size from 22 to 28 will work as long as the wire is enameled to keep the turns from shorting. The antenna, ground, and headphone terminals are made from paper clips. The sliding coil contact is a paper clip bent and mounted to maintain downward pressure on the coil. I soldered the pivot end of this arm to a washer and fastened that to the board with a screw. W8EFW simply bent the end of the paper clip around a tack. Running the arm back and forth across the coil several times makes enough of a mark to show where the insulation must be scraped away for the arm to make contact. I also soldered all the wire connections to improve reliability. The radio will work without that step, but it does make life a little easier.

It goes without saying that this radio, like its brother, the crystal set, needs a good antenna and ground. The easiest thing to use for a ground is the screw holding the cover plate to a standard ac outlet. If it's available (and made of copper), the house water supply may make a better ground. An acceptable antenna can be made from 50 feet of wire routed out a window and away from the house. Keep the far end as high as possible and use more wire if you can. As far as this radio is concerned, there can never be too much antenna!

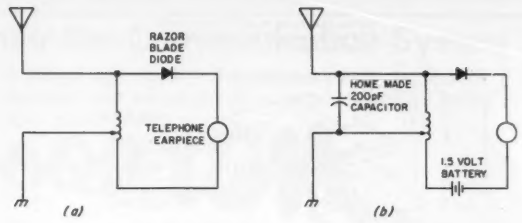

Fig. 1. Complete schematic of the Foxhole radio. The original circuit (a) was built by GIs all over the world during WWII. The addition (b) of a tuning capacitor and a dry cell (to bias the detector) improves reception.

This set works best if the old-style high-impedance headphones are used. The new, low-impedance hi-fi types would work only with a matching transformer. If the proper phones aren't available, you can always do what the GIs probably did—borrow the earpiece from a telephone handset. The Ma Bell earpiece shown in the photographs has a dc resistance of 6 Ohms and an ac impedance of about 150

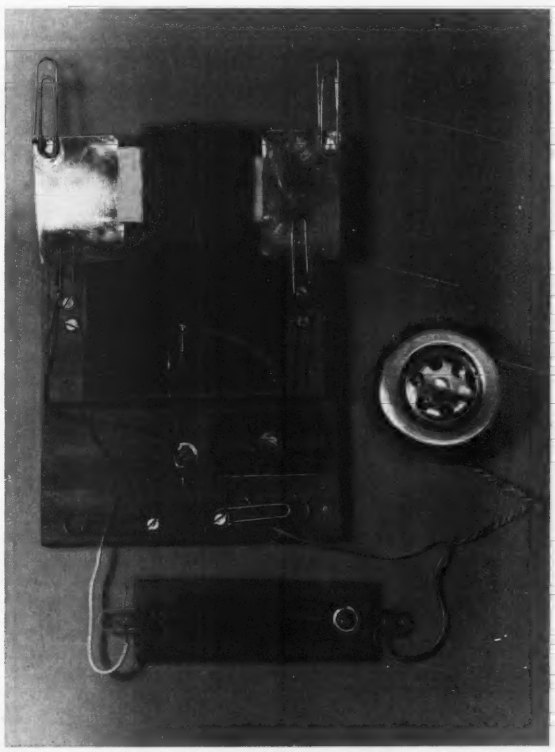

Photo B. Never content to leave well enough alone, the progressive amateur will be looking for high-performance modifications. Here are two: The homemade tuning capacitor and detector bias pack will boost both selectivity and sensitivity.

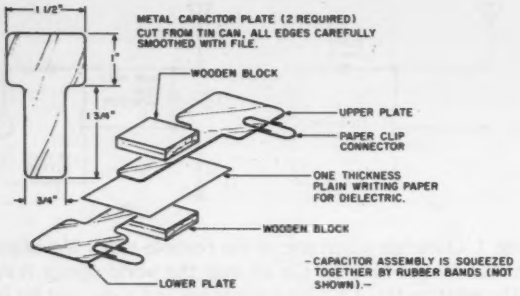

Fig. 2. Home-brew 250-pF (more or less) capacitor.

Ohms. It works almost as well as real headphones.

Operation

There's certainly nothing sophisticated about tuning the Foxhole radio. Check the wiring, hook up the antenna and ground, and connect the earphones. Set the slider to the middle of the coil and start listening. Move the point of the pencil lead slowly across the lettering on the razor blade until you hear a station. Try several different spots because some will work better than others. As a final step, move the slider across the coil until the signal strength is maximized.

The performance of the Foxhole radio will depend on your skill in adjusting the detector and the efficiency of your antenna. W8EFW claimed a range of 25 miles with a good antenna and ground. At my location, two nearby stations (about 5 to 7 miles away) dominate the set so I can't hear anything further away. Those local stations are quite clear, though, and come in with reasonable volume.

DX Accessories

There are several ways to improve the performance of this little radio, and luckily they're both cheap and easy. The first thing to add is a capacitor for resonating the coil, as shown in Fig. 1(b) and Photo B. With my antenna, that gave a noticeable boost to headphone volume and also let me separate the local stations. My friend W1GSL found that at his QTH the capacitor worked best when it was in series with the antenna. The capacitor always improved reception, though, so it's certainly a worthwhile addition.

An old 365-pF broadcast variable is perfect for the job, but you'd be cheating to use one. It's more sporting to make your own capacitor with plates cut from a tin can.

First cut (*very carefully*, those edges are sharp!) a pair of T-shaped plates, as shown in Fig. 2. Smooth the edges with a file and solder on two paper clips as shown. These two plates, separated slightly by an insulator, will be clamped together between wooden blocks to make a fixed 200-pF capacitor. That unit can then ride piggyback on the set, as shown in Photo B.

At first I tried using cellophane tape for the dielectric. That had a lot of dc leakage, so plain writing paper was used in the final version. One layer of paper between the plates makes a nice capacitor and gives about 100 pF per square inch of plate area. Any capacitance value between 150 and 350 pF will work, and the final value can be adjusted if necessary by sliding the plates to change the amount of overlap.

The other circuit improvement is the addition of a 1.5-volt battery to bias the detector further into its nonlinear region. What? A "crystal" set with a battery? The idea may seem strange now, but in the early days of radio that technique was quite common and, in fact, necessary with some of the crystal materials used. Current drain is only one or two mA, so battery life shouldn't be a problem.

The battery holder shown in Photo B matches the style of the rest of the "equipment" and is also easy to make. When using the battery, you may find it easier to adjust the detector first and then add the battery bias for a boost in signal strength. The battery simply goes in series with the headphones. Try flipping the battery polarity several times, as one direction may work better than the other.

Conclusions

The Foxhole radio is cheap to build and fun to operate, but it certainly isn't the world's best "crystal" set and you won't spend hours listening to it. Amazingly, though, it does work, and its story is a truly fascinating bit of radio history. More than just a history lesson, however, this project will also leave you with two long-term benefits.

First, it gives you a perfect way to win "sucker bets" with friends who don't believe you can build a working radio using household materials and no commercial tubes, transistors, or diodes.

Second, you'll have a lot more respect for the rectifying properties of imperfect connections. That's helpful in those cases of harmonic-type TVI which occur despite the use of a properly adjusted transmitter and a good low-pass filter. Rectification generates harmonics, but when searching for the diode, it sure is easy for the inexperienced ham to overlook the rusty joints in his neighbor's TV mast! ■

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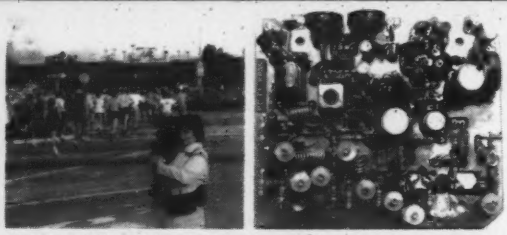

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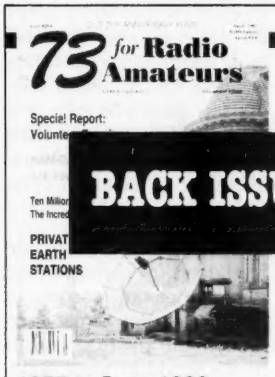

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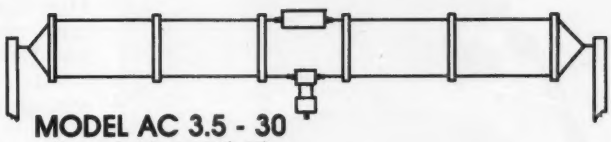

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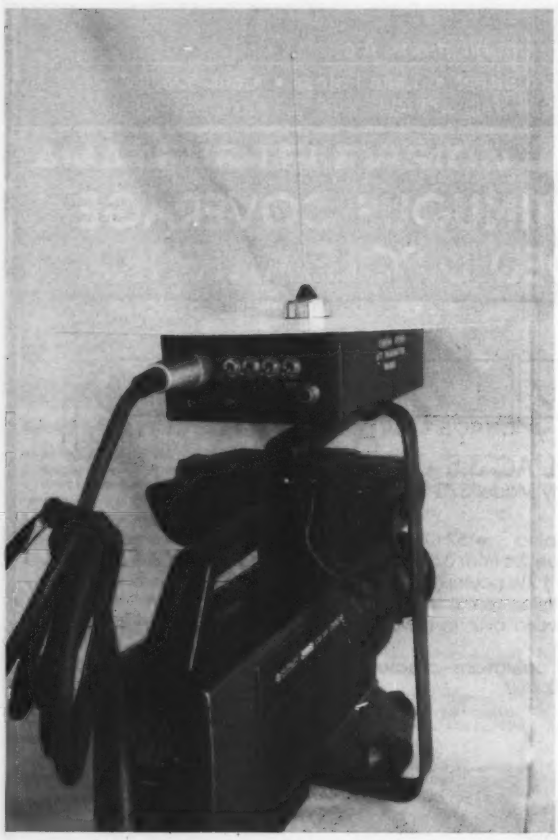

Photo A. Camera with transmitter in a Hammond #1590D housing. Also shown is the thirteen-inch ground-plane disc needed with most cameras for an rf shield. (Photo by P.C. Electronics)

The present generation has seen home television grow from a sprouting of folded dipoles on rooftops and seven-inch viewing screens to a wonderful array of hi-tech toys. At the present time, hardly a household, cottage, or mansion in any corner of the land is considered livable without at least two TV sets.

As video literacy increases, so does hardware awareness. This raised consciousness soon starts to lobby for a video recorder. After that, a camera becomes almost mandatory. Sound familiar?

Video recorder/camera combinations open a world of creativity undreamed of by any hacker (to borrow a term) previously limited to using a movie camera with its problems of film editing and projection. Now even one of the major photography magazines is talking about the "video explosion." This is great stuff and apparently there is a separate subculture growing rapidly out of these new mass-market technologies. There is a large area of opportunity available, however, for individual and personal creative video work which remains largely untouched. This is ATV: amateur television.

Broadly speaking, this aspect of television will remain untouched because it is absolutely illegal to be active in it without an appropriate license. Most readers, however, will know that A5 emission (video) is perfectly legal for any holder of a Technician-level or higher amateur license with privileges above 420 MHz. But of the large number of amateurs qualified for operating in these bands, only a relative few work with ATV. It is estimated that fewer than 3,500 are active in traditional fast-scan amateur television.

Admittedly, this mode has been slow in developing for a variety of reasons. In the less populous areas even today, your pix may go out to the world in great style. But you may have a long wait for someone to come back to your call.

Until recently, a lack of inexpensive appliance hardware for the job was a major obstacle. And, of course, the "strangeness" of video electronics probably continues to intimidate a lot of folk. But given the type of mind associated with amateur radio, intimidation has got to be a poor excuse. Consider the evidence. Personal com-

puters, for example, are being welcomed into the shacks with open arms and creative understanding. And the few on the cutting edge who have mixed ATV and computer graphics have come to know the true meaning of remote screen.

ATV is in line to benefit greatly from an outpouring of mass-market video hardware. It has flooded retail stores everywhere. Seventy centimeters in particular could be on the verge of new popularity as one result of this windfall.

An easy way to get into video on this band or to build on an existing base is via the P.C. Electronics one-Watt video transmitter which is sold as a wired and tested PC board module (sales limited to holders of Technician- or higher-class licenses). You will find this video transmitter to be a very high-quality unit. It is also a perfect natural for ham use. At this writing, it has no equal in performance, ease of packaging, and general utility in its price range. Its relatively low cost derives in part from the need for the buyer to personalize the case and design the control placement.

The P.C. Electronics board is fully populated, factory aligned, and tested. In fact, you can give it a performance check on your own bench rather quickly. The full utility of the KPA5 transmitter package, however, doesn't surface until it is configured for truly portable/mobile operation—which leads us to the object of this article.

About the only power tool needed to prepare a housing is a 1/4-inch or larger electric drill. This is necessary to drill a variety of holes.

What you pay P.C. Electronics for is a neat little circuit board about 3-1/16" × 3-3/4" which is tightly packed with all the necessary goodies. This video transmitter will accept composite video and audio from a camera, videotape recorder, or computer. And there is a separate input line for a low-Z mike. The board comes supplied with four mounting holes for #4-40 × 1/2" screws.

It can be ordered with two switchable crystal-controlled frequencies of your choice. You specify what you want between 421.25 and 439.25; 439.25 is the commonly-used calling frequency in the eastern states and midwest, and 434.00 is the frequency of choice for the west (second crystal extra at fifteen dollars).

Normally, no adjustments are needed on the board as received from the factory. However, only a voltmeter is required for realignment if the need arises. Instructions for this procedure are provided with each video board purchase, together with a complete circuit diagram and setup instructions. (*A5 Magazine* for April, 1984, carries a full-page spread of the schematic.)

Now, as mobility and portability figure in all of the hot applications for this mighty mite, the housing must be very sturdy. There are several options and you may have one in mind which is just right for you. However, if your plans include joining camera and transmitter into a single-unit shoulder mount and you want the smallest possible package, the Hammond #1590C die-cast aluminum box is a good choice. At 4.3" × 3.6" × 2.2", it is just large enough to house the board and connector ports.

You may want to consider a larger one, as illustrated in Photo A, however. Shown here is a camera with a transmitter installed in the larger, Hammond #1590D housing. Also shown is the thirteen-inch ground-plane disc that is needed with most cameras for an rf shield in this close-coupled assembly.

It should be noted here that the original KPA5 design purpose ("visual" parade-control communications) required the smallest possible package. Some of the spin-off applications also demand an ultra-compact package. But there are general-purpose uses which can benefit from a slightly larger housing and at the same time not rule out the original design purpose.

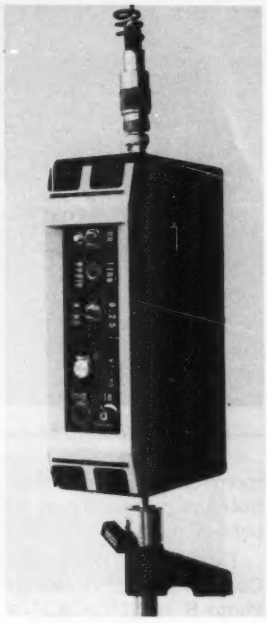

Photo B. The ready-to-use 1-Watt video transmitter supported by a tabletop photographic tripod. The optional bezel is described in the text.

As we had a broad base of application in view, it was decided to start with a box size that would have enough

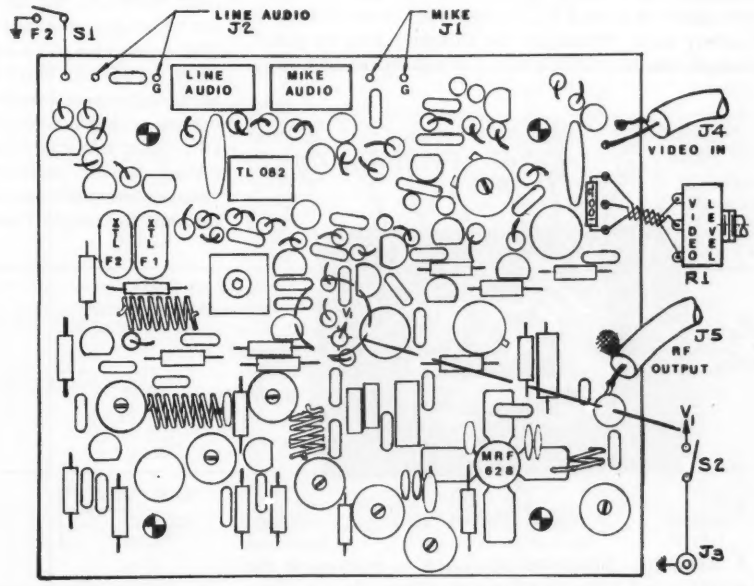

Fig. 1. General parts layout with control options labeled for use with a nonspecialized video connector. (Drawn to scale from P.C. Electronics material)

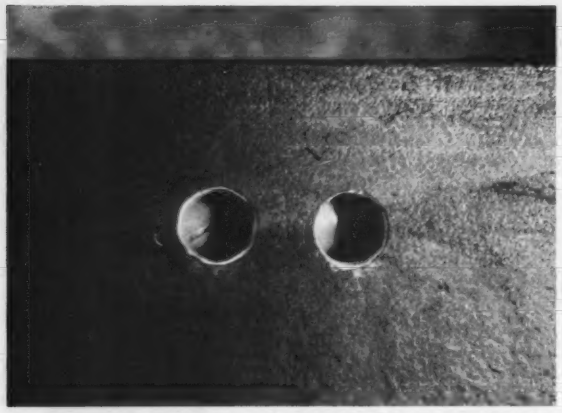

Photo C. Close-up of audio-adjustment access holes.

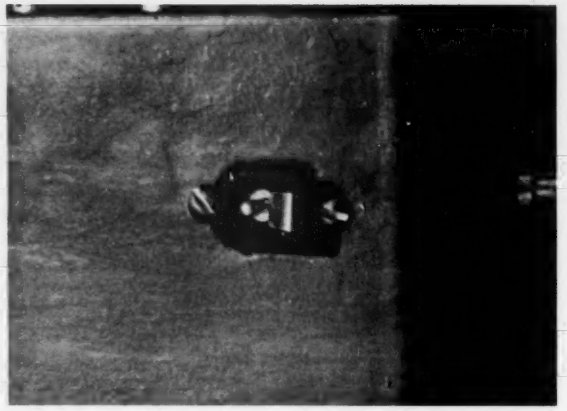

Photo D. Close-up of power-jack installation.

room for some external controls and perhaps future expansion.

This housing (Hammond Cat. #1590R), shown in Photo B, is 2.2″ × 4.3″ × 7.5″. There are several other sizes to choose from such as the Hammond #1590D (Photo A) or Bud CU247 in the die-cast line. The Hammond die-cast boxes are available in a gray hammertone at additional cost.

If you want to use a camera and transmitter as separates, a larger enclosure makes sense. The added room makes for easy control placement and it is possible to plan space for a small 12-volt battery pack. Although this feature was not made a part of our transmitter package, an integral battery will be easy to add and will be useful for tests and short events.

There are three basic options for control placement. The first is to keep the audio and video pots as they are on the board without change. This option may apply best when the small housing is used. The second option is to bring these pots outside for external control. (The board is drilled for these wires.) A third choice is to go with a combination, as shown in Fig. 2. The thought here is that only the most often used controls need to be brought out to the panel.

For example: The locations of the audio line and microphone pots on the board are suitable for adjustment with a screwdriver (Photo C), but since it is important to have quick access to the video-level control, this one should be brought to the outside. To do this, the video-level pot located on the board is removed and the panel-mounted pot (R1) is wired in . . . leads no longer than three inches, and twist them together, please!

The power input jack (12–14 V dc) is shown in Photo D.

A further selection must be made on the type of video input receptacle to be used. Basically, the choices are between a simple RCA or BNC connector as found on some VTRs and black-and-white cameras or a multi-pin mating socket for your specific camera. With this latter option, power, audio, and video connections are made through the single connector. An important concern is raised if this is the choice. Be certain that a matching socket is available for the connector on any camera you intend to buy. Although there is some standardization, it is not entirely reliable.

Fig. 1 shows a parts layout based on a nonspecialized video connector. Control options are labeled.

A standard 1/4-20 tripod socket (Photo E) mounted on the bottom of the case can provide a sturdy attachment point for a large variety of commonly available photographic hardware, such as tripods and clamps. It can also be used as part of a camera/transmitter bracket, if this option is planned.

So-called "parts cameras" are the best source for tripod sockets. Most camera repair shops can be helpful in this area if the old junk box is unproductive.

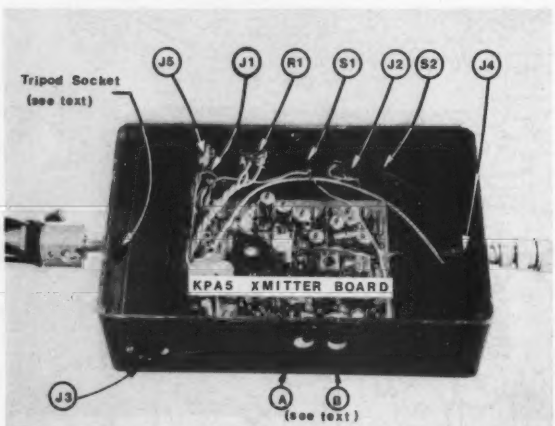

Fig. 2. A middle-of-the-road approach to packaging the transmitter board. Video-level control is brought out to the panel as are connector jacks and switches. Audio levels are screwdriver-adjusted through access holes A and B.

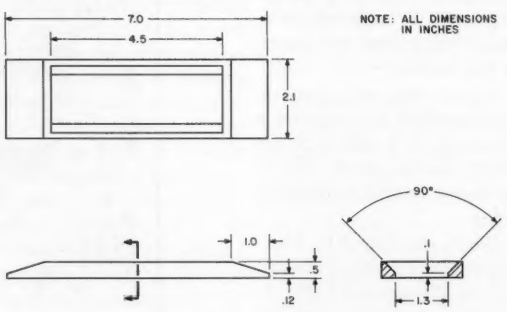

Fig. 3. Bezel dimensional drawing. This is an optional item which can be added at any time. Its basic purpose is to act as a switch guard, but it also improves the appearance.

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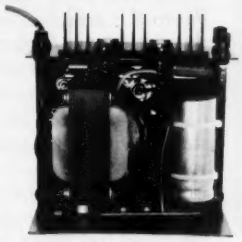

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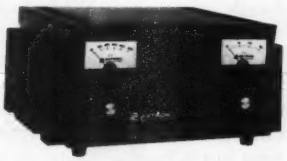

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MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

• Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

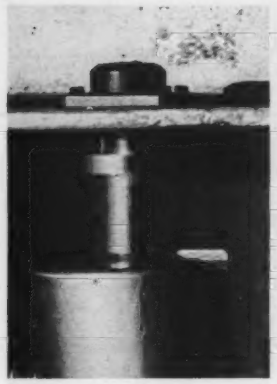

Photo E. Close-up of tripod-socket installation. See text for details.

Photo F. Panel layout. The bezel (see text) shields the switches from accidental tripping.

The 500-Ohm video-level pot (R1) must be shunted with a 100-Ohm resistor. A 100-Ohm pot is preferred for this spot but is hard to find (Fig. 1).

An antenna can be put together quite simply. First, a 6-1/2″ length of #22 rod is soldered to a BNC connector. Next, this is stabilized with an epoxy filler. Presto, a serviceable antenna! This simple whip can be expected to give good usable pictures at distances of up to a mile. A commercial antenna such as a Yaesu, part number YHA-44, or similar will also work well.

Where maximum mobility is not required or for use as part of a base station, an amplifier such as the Mirage D-24 will boost 1 Watt of video up to as high as 40 Watts. This amount of power generates a respectable signal, especially if working into a high-efficiency antenna such as a KLM 440-27.

It goes without saying that do-it-yourself projects tend to reflect the wants and wishes of the doer. This project is open to considerable variation. The bezel, for instance (Photos B and F and Fig. 3), makes an effective switch shield. But it can be eliminated or altered in a number of ways. The bezel, detailed in Fig. 3, can be cut from a piece of 1/2″-thick plastic. It also can be made from four pieces (or more) cemented together or even cut out of a piece of 1/2″ balsa. The bezel visible in Photo B is attached with industrial epoxy. A couple of screws would do as well.

As cameras follow the apparent destiny of all solid-state devices and continue to shrink in size, mobile video will be in a position to become as commonplace as FM hand-helds are today. You can have it now with a package not much larger than some of the HTs of just ten years ago. Applications in use at the present time include robot coordination, model-plane flying, model-boat sailing, and public service with parades, marathons, and other people-oriented events.

Some pioneer work has been done with weather watch, and walk-about video capability makes lots of expansion possible. In addition to these public-service opportunities, there is always plain old hamming to fall back on. That is sort of fun, too...but I suppose you know that. ■

Parts List

R1 500-Ohm carbon or cermet pot (see text); Circuit Specialists, cat. #31VA205
S1 SPST submini toggle (Radio Shack #275-324)
S2 SPST submini toggle (RS #275-324)
J1 Std. 1/4″ phone jack, 3-conductor (RS #274-312)
J2 Std. 1/8″ mini phone jack (RS #274-251)
J3 Coaxial power jack (RS #274-1565)
J4 Type UG1094 female BNC connector (RS #278-105)
J5 Type UG1094 female BNC connector (RS #278-105)
PL Coaxial power plug (J3 matching) (RS #274-1567)
Knob—For 1/4″ shaft (RS #274-407)
Bezel—(see text)

KPA5 Video Xmitter board with one crystal: $159.00
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2522 Paxson Ln.
Arcadia CA 91006

Housing—(see text)
Bud Econoboxes
Shand Electronics
2401 Dort Highway
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572B	42.50	8643	82.50
811A	12.00	8844	26.50
813	30.00	8873	175.00
6146B	7.00	8874	195.00
6360	4.25	8877	495.00
6883B	6.75	8908	12.50

Semiconductors

MRF 245/SD1416	$30.00	MRF 644	$23.95
MRF 454	18.95	SD1088	19.95
MRF 455	13.95	2N3055	.75
		2N6084	12.50

RF Connectors

PL259	10/$4.95	M358	2.50 ea.
PL258	10/8.95	M359	1.75 ea.
UG175/176	10/1.60	Type "N" Twist on	
UG255/u	2.50 ea.	(RG8/u)	$4.75 ea.
UG273/u	2.25 ea.	Minimum Order $25.00	

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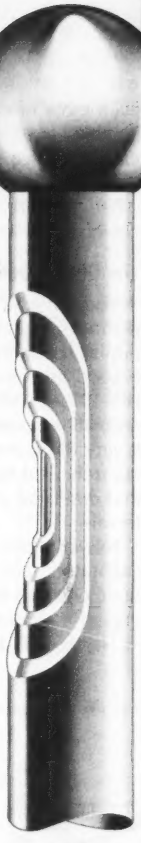

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Modification Mania!

Here are not five, not ten, but fifteen *ways to perk up your HW-101.*

Wayne Arnett AI7C
3315 N. Apollo Drive
Chandler AZ 85224

When the Heathkit® HW series was first introduced, Hammarlund was still making receivers and most of the activity on two meters was AM simplex. It's tempting to think of the HW-101 and other tube-type gear as relics of another era. But Heath products tend to age gracefully, and the HW-101 is no exception.

Even though it's a little behind the times, this transceiver has a reputation for good performance at the right price. This article describes several modifications that make operating even more effective and enjoyable. Most of them are easy and inexpensive. These ideas can also be used in the other HW/SB series transceivers.

The Digital Debate

You can lead a normal life without digital frequency display, but only if you have a good analog dial. On the HW-101, it's miles between calibration points. This makes it very difficult to locate accurately subband borders that don't fall at 100-kHz intervals.

Newer radios use 25-kHz calibrators, and it's easy to build one into the HW-101. I copied the crystal calibrator in Heath's HR-1680 receiver and added a divide-by-four flip-flop IC to the output—see Fig. 1(a).

To install the new circuit, first disable the old V17B calibrator by removing R217, R218, C218, C219, and CR201 from the bandpass board. Leave the 100-kHz crystal in place, but isolate the foil patterns around its pins.

Recycle the 8–50-pF trimmer into the new calibrator and build the circuit on a small square of perfboard. Suspend the board on stiff wires soldered to the ground foil underneath V17. Then connect the crystal with short leads.

Unsolder the white wire at pin 3 of V17 and use it to bring 12 volts dc from the function switch to the new calibrator. Move the small coax cable from CR201 to the 25-kHz output. Finally, rearrange the function switch as shown in Fig. 1(b). The dc power supply needed for this and some other additions will be described later. The changes to lugs 5 and 6 of the function switch also are covered elsewhere.

A Sixth Band

Access to WWV will help you take full advantage of the new calibrator. At 15 MHz, WWV is close enough to the 20-meter ham band that only a new crystal in the heterodyne frequency oscillator (hfo) is needed to provide the additional coverage. Since 20 meters can't be sacrificed, a switching arrangement is used.

Instead of running long

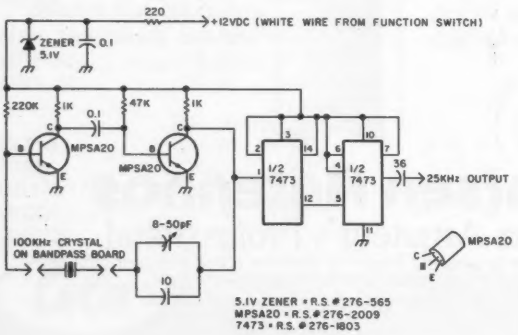

Fig. 1(a). 25-kHz crystal calibrator.

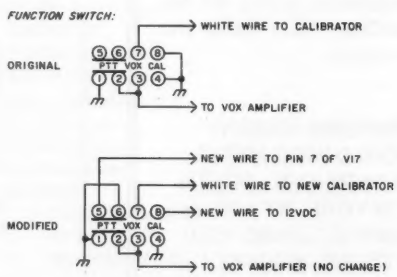

Fig. 1(b). Modified function switch.

wires from the hfo crystals to a distant switch, I decided to use a small relay, as shown in Fig. 2. The new 23.895-MHz crystal and relay were mounted on perfboard and attached to the center shield near the crystal board (see Photo D). The crystal is Heath part no. 404-279. A toggle switch on the rear panel controls the relay, which selects 20 meters or WWV when the bandswitch is at 14 MHz. The relay also grounds the WWV crystal when it's not in use.

To get the WWV assembly into the hfo circuit, make a cut in the crystal board foil between the switch wafer and 20-meter crystal (Y503). Then drill a small hole on each side of the cut, bring short leads forward to the relay, and connect as shown.

You shouldn't have to realign anything which might compromise 20-meter performance, although the hfo coil (L603) may need touching up if the new crystal won't oscillate. Avoid using a 23.395-MHz crystal for 14.5–15.0-MHz coverage because WWV then appears at 500 on the main dial. This results in a two-tone competition between WWV and the third vfo harmonic.

Since the transmitter is not disabled when tuning 15 MHz, a front-panel "reminder" LED should be included. Calling CQ on 15.175 is discouraged, and Radio Moscow doesn't count toward DXCC, anyway.

Receiver Incremental Tuning (RIT)

Even early CB rigs had clarifier controls, but for reasons known only to Heath, RIT has until recently been absent from their transceivers. Fortunately, an RIT circuit is easy to install, and several schemes have been published in the past.

Two circuits I've used successfully in my HW-101 were found in the Holiday, 1976, issue of *73* ("Add RIT to Your Transceiver," *73* Staff) and *QST* for October, 1974 ("Hints and Kinks," K4EQA).

However, I've noticed that most add-on RITs share a common deficiency. They have no on/off switch and depend on the operator's best guess to position a knob in just the right place. Ironically, this often results in off-frequency calls or "leapfrogging," which are the very problems we're trying to eliminate in the first place.

An on/off switch can be designed into an RIT by using a multi-turn trimpot and frequency counter to balance out the circuit's effects on the vfo when it's turned off. I found it simpler, though, to use a Protronics RIT kit. This includes a center-stop detent in the tuning control and a voltage-regulated zero point. This "click-stop" is just as good as an on/off switch and virtually eliminates off-frequency calling.

I have built three of the kits into different transceivers without any problems. They come with instructions and cost about $15.00. Get the details from Protronics, Inc., Box 778, Buckley WA 98321.

While you have the vfo assembly removed for an RIT modification, put a dab of caulk between C946 (the large 4700-pF disc) and the aluminum enclosure. This will hold it still and help prevent the vibration-caused microphonics common to some HW-101s.

Better CW Performance

When the HW-101 is properly tuned to an incoming CW signal, the beat note you hear is a rather high-pitched 1000 Hz. This departure from the current norm of something close to 750 Hz is tiresome to the ear. It's also not ideal for some audio filters and computer interface units. Slow-recovery agc is another strike against the serious CW operator.

I modified the mode switch to pad the USB/CW bfo crystal down by 250 Hz

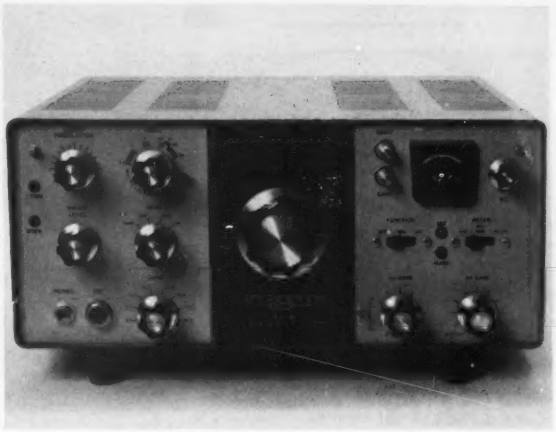

Photo A. The finished product with new controls, LED status indicators, and spinner knob.

and to select fast agc when operating CW (refer to Fig. 3). By extending the mode-switch shaft to accommodate another wafer, two new switch sections are made available. Even after moving C15 and C26 to the foil side of the modulator circuit board, space is at a premium for the extended mode switch. Choose your new switch hardware carefully.

One section of the new wafer places padding capacitance across the bfo crystal which is adjusted for a more pleasing tone. The other section connects a trimpot in series with R117, the agc timing resistor. In my case, about 500k gives a "snappy" agc without popping on strong signals.

Since the 400-Hz CW filter is in the i-f stage, it is not affected by the lower bfo frequency. In other words, it will work just like it used to, except the signal that's centered in the filter's passband will appear at the speaker as a 750-Hz note. The transmitter offset will still be correct.

You're right if you think this isn't a ten-minute job. The same improvements can be made with a double-

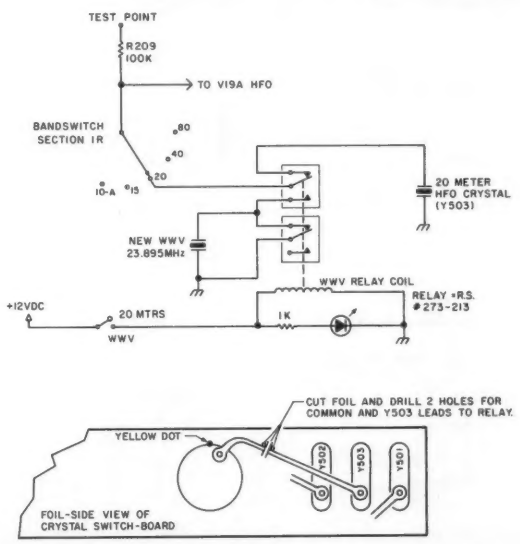

Fig. 2. Modification of hfo circuit for 15-MHz WWV reception.

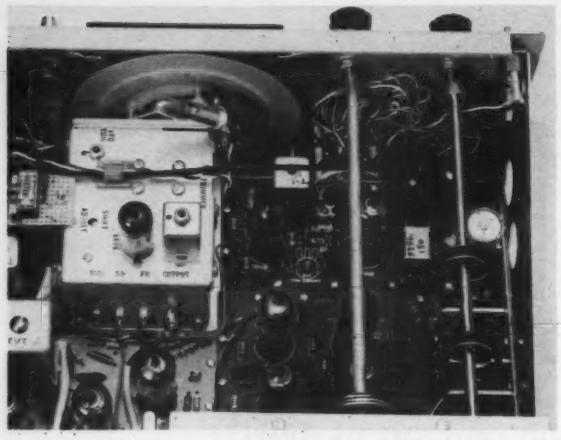

Photo B. Close-up of modified three-wafer mode switch. S-meter relay and front-panel VOX controls are visible at the far left.

pole toggle switch mounted near the bandswitch (again, see Fig. 3). This comes closer to being quick and easy, but it's less convenient since the toggle switch has to be remembered when changing between USB and CW. For me, the benefits were worth the trouble of rebuilding the mode switch.

Another problem for CW buffs with the stock HW-101 is not being able to check keyer speed without sending a signal. It is also impossible to manually control CW transmission, such as with a send/receive switch. As originally wired, the rig changes to transmit mode any time the key is tapped.

A minor change to the function switch allows manual T/R control while leaving sidetone operation intact. Note the new connections to lugs 5 and 6 in Fig. 1(b). With the switch in PTT position, the tone-generator output is grounded on its way to the VOX amplifier, which prevents the transmitter from being keyed. Now the sidetone is audible in receive mode, and the keyer can be adjusted without transmitting.

For semi-break-in operation, set the function switch to VOX. To manually activate the transmitter, connect a normally-open foot switch (or any other external T/R control) from point 16 on the bandpass board to ground. Set the function switch to PTT, and the VOX circuit is disabled.

Civilized Audio

Of all the HW-101's shortcomings, probably the one that most affects non-ham family members is the sidetone. It's earsplitting volume can't be tamed, and only the most considerate ham will consent to wear headphones.

I maintained domestic tranquility by duplicating the SB-102's sidetone volume control in my rig (see A in Fig. 4); put the 500k control on the rear panel and you easily can adjust the sidetone between silent and obnoxious.

The front-panel headphone jack is intended for high-impedance phones, which is quaint but not very practical. Adding a phone jack to the speaker cabinet is easy enough, but it's also a simple procedure to modify the front-panel jack for eight-Ohm phones (see B in Fig. 4).

Move the 100-Ohm resistor from the speaker phono socket to the audio transformer's green lead. Use shielded cable to carry eight-Ohm audio to the headphone jack, and back to the speaker socket.

With every microphone I've tried, full SSB output was possible only by running the mike gain open and shouting. In a previous article (*73*, October, 1981), K5SE described a mike preamp using tube V5B in the HW-101. This works very well, but I wanted to reserve V5B as a buffer for remote vfos. The circuit shown in C in Fig. 4 was adapted from one found in *The ARRL Handbook*, and seems to work just as well.

The preamp can be built on perfboard, but for this and other small circuits such as the 25-kHz calibrator, I prefer Radio Shack's experimenter boards (part no. 276-154). These boards will accommodate ICs and the DIP-type relays, and can easily be cut to size.

Drill mounting holes in the side rail near the microphone jack and suspend the board on spacers or washers. Use small hardware, #2 or #4, to prevent binding between the mounting screws

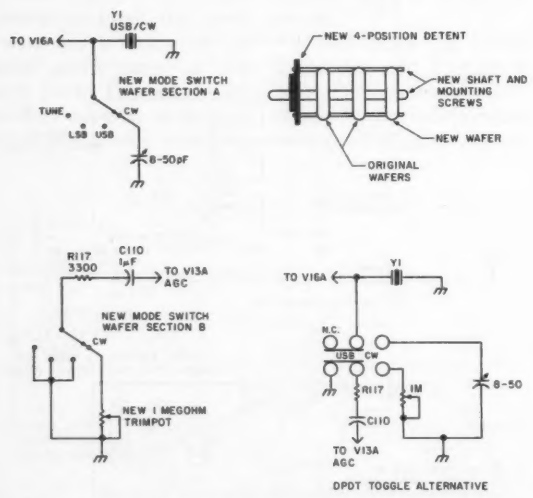

Fig. 3. Two methods of changing CW bfo frequency and obtaining fast/slow agc.

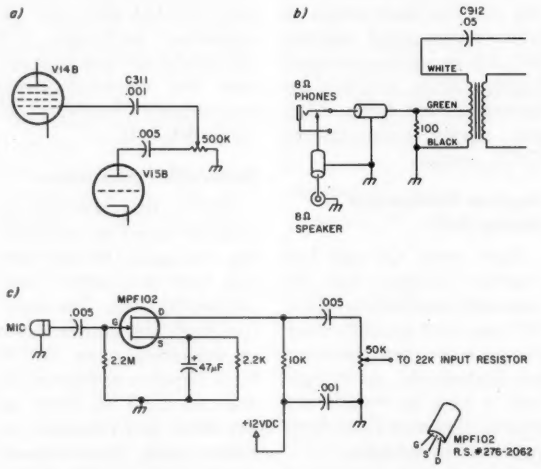

Fig. 4. The SB-102 sidetone level control is at A. At B, the audio transformer output is rewired for 8-Ohm output to speaker and phones. C shows a simple microphone preamplifier.

and the lower cabinet shell. Adjust the 50k trimpot for full modulation while speaking normally, with the HW-101's mike gain at about the ten o'clock position. I found that shielding was not required, but a bypass capacitor on the 12-volt line is recommended.

Crystal-Filter Selection

Many HW-101 owners have had problems with the crystal-filter switches and the linkage that operates them. The lever behind the rf-gain knob is prone to breaking, and the slide switches get dirty and show contact resistance after a period of time.

For a partial fix, you can loosen the rf-gain-control nut and then re-tighten it while pushing upward on the control. This helps reduce friction between the linkage lever and the lower chassis lip. The slide switches can be cleaned by removing the backs and shining the contacts. But you have to be careful doing this because the switches like to send springs and pieces flying in all directions when they're disassembled.

I chose a more permanent solution which eliminates the old switches and linkage altogether. A miniature relay and a DPDT toggle switch were substituted for the two slide switches, as shown in Fig. 5. One pole of the new toggle handles the output side of the filters, while the other pole controls the relay, which in turn handles the filter inputs.

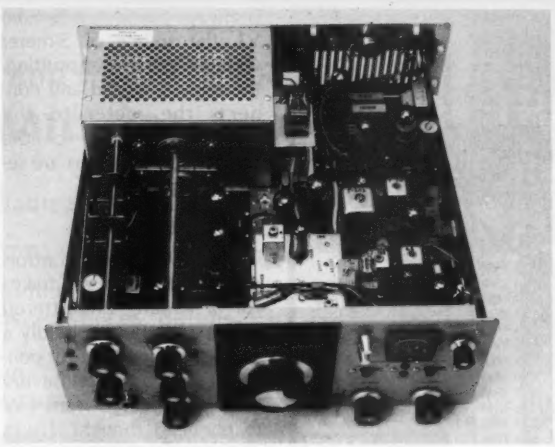

Photo C. Note "missing" calibrator components and rear-panel sidetone control. The relay on the rf cage is for outboard vfo control.

Like some of the other modifications, this one requires a new hole in the front panel. What worthwhile project doesn't? I bought my rig to use, not to sit under a dust cover waiting for resale. Besides, the trade-in allowance on a kit-built, non-WARC transceiver is debatable to begin with, so I've had few concerns about reaching for my drill.

First, remove the combination rf-gain control and switch lever. Disconnect all wires from the slide switches and crystal filters, and take off the back of the DPDT slide switch. Take a deep breath if you must, and drill a hole centered between the letters T and E of the word FILTER, of sufficient diameter to pass the new toggle switch.

Install the miniature relay into the now-empty frame of the slide switch nearest the center shield, using double-sided tape to secure it. Make the connections to the new toggle switch before installing it on the front panel because it's impossible to reach once it's in place. Reconnect the crystal filters as shown, and position the new switch to coincide with the arrow and SSB/CW markings on the front panel.

Finally, install a new 100k linear-taper potentiometer for the rf-gain control. If the new hole was correctly centered, the toggle-switch nut and washer should cover the word FILTER, leaving a new control that looks (almost) factory standard.

By maintaining the original distance between input and output poles of the filters, I haven't been able to detect any degradation in

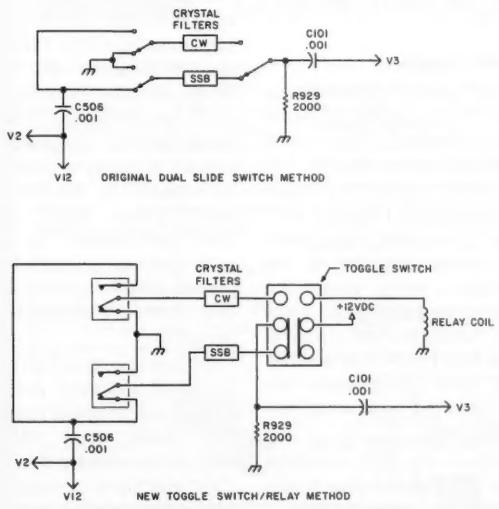

Fig. 5. The unreliable and noisy slide switches are replaced with a toggle switch and relay for crystal-filter selection.

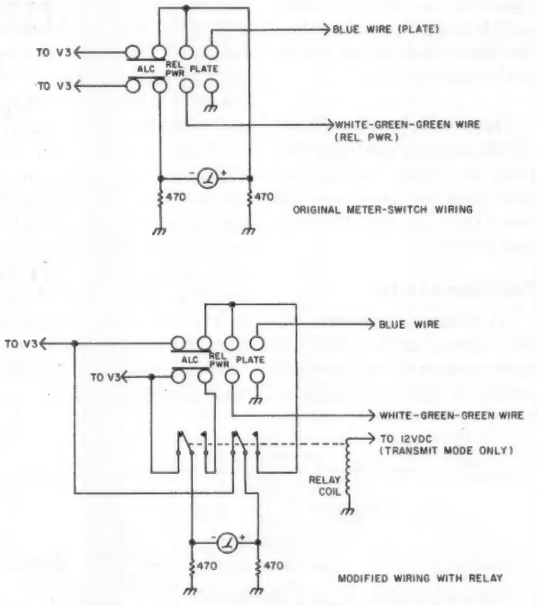

Fig. 6. The new relay makes the S-meter independent of the meter switch. Observe meter polarity when connecting relay to switch.

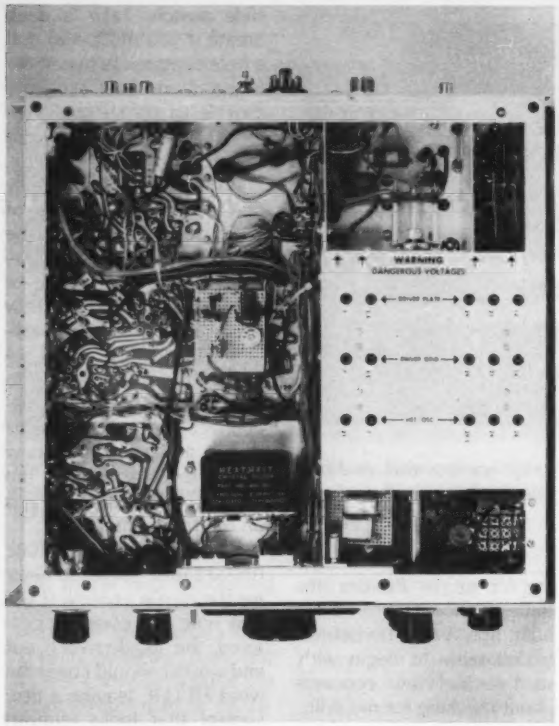

Photo D. Bottom view, showing placement of dc power supply, calibrator, crystal-filter relay, WWV board, and microphone preamp.

performance or additional leakage around the filters. But you will detect both if you use a three-section switch in place of the relay, or otherwise decrease the input/output isolation.

This switching method can be used for adding a CW filter to other transceivers that have no provision for one, such as the HW-100 and SB-100.

Full-Time S-Meter

As originally designed, the S-meter in the HW-101 works only with the function switch in the ALC position. Without a lot of wear and tear on the meter switch, it's not possible to monitor plate current while transmitting and signal strength while listening. If you want to keep your S-meter on the job all the time, take a look at Fig. 6 and make these changes.

Mount a relay and two 470-Ohm resistors on a small piece of perfboard, and wire as shown. The assembly can be attached at any convenient location near the meter. Don't forget to clip the original resistors from the meter switch.

In receive mode, the meter bypasses the switch and is always connected to tube V3, the source of S-meter voltage. When transmitting, the relay is closed and connects the meter to the switch, where any of the three meter functions are selected normally.

VOX Controls

Hiding the VOX controls on the side of the rig makes for a clean, uncluttered front panel. But it's hardly a convenient location for controls that are adjusted every time you change from CW to phone. I thought it was only sensible to relocate the delay and gain controls to the front panel; the set-and-forget anti-trip isn't worth moving.

The existing controls do not have shafts and can't be used with knobs. There's room for new controls to the left of the meter, but be careful not to crowd the tuning dial. A 10-megohm linear-taper pot is a good substitute for the hard-to-find 7.5-megohm delay control.

Route the lead from the delay control through the notch in the i-f board and back to its original location underneath V12. The shielded cable from the gain control can be strung across the vfo and soldered directly to the mike gain control, where coax cable #3 is now connected.

Power Supply

For some of the modifications in this article, 12 volts dc is needed. This is not available in the HW-101, but it's easy to build in a small power supply. Filament voltage is borrowed from point 12 on the foil side of the bandpass board, where the large brown and white wires are connected. The circuit is shown in Fig. 7. The rectifier and filter components can be mounted on a small terminal strip.

Attach the 7812 regulator and the terminal strip to the center shield near the antenna relay. Twelve volts dc is available continuously on demand to most circuits, but on transmit only (via spare contacts on the antenna relay) for the S-meter relay and any future additions.

And Finally...

With nothing but phono sockets on the rear panel, it's all too easy to load up the station speaker on 40 meters. Of course you can do this only once per speaker, so it might be better to replace the antenna socket with an SO-239 coax connector. A reamer or 5/8-inch punch will enlarge the existing hole.

A vfo spinner knob with a finger hole is the poor ham's economy scanner. You still have to turn the knob, but it goes much faster. The one used on the SB-104 (Heath part no. 462-906) works well and matches the HW-101.

Some early versions of the HW/SB series used 1N34 diodes in the balanced modulator. Later, they were changed to FH-1100 hot-carrier diodes for better audio quality. Check your owner's manual to see which type you have. If you want to make a change, the four diodes are located on the modulator board, right behind the mode switch. FH-1100s are Heath part no. 56-87.

This article is only a fraction of all that's been written about the HW-101 and the almost-identical HW-100 and SB-100 series. The basic design of these popular rigs is not yet outdated, and the specifications compare favorably with many "hybrid" transceivers at double the price. These radios offer good performance to start with, and can be further improved by any owner with even limited workbench experience.

So don't be afraid to raise the hood and poke around. There's not a single component inside your HW-101 that can be damaged by the static electricity on your fingertips. If you have any questions or problems, let me know, and I'll try to help. ■

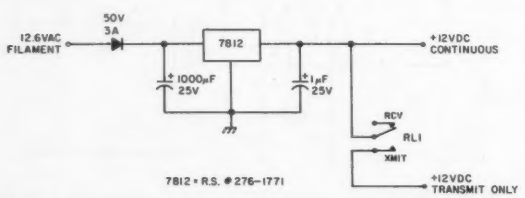

Fig. 7. Regulated power supply for modifications. Don't overlook the 1-μF capacitor at the 7812 output.

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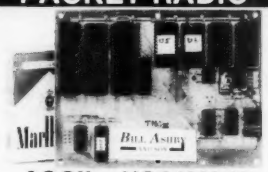

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MRF426*	25W	17.00	40.00
MRF426A*	25W	17.00	40.00
MRF433	13W	14.50	32.00
MRF435*	150W	42.00	90.00
MRF449	30W	12.00	27.00
MRF449A	30W	11.00	25.00
MRF450	50W	12.00	27.00
MRF450A	50W	12.00	27.00
MRF453	60W	15.00	33.00
MRF453A	60W	15.00	33.00
MRF454	80W	16.00	35.00
MRF454A	80W	16.00	35.00
MRF455	60W	12.00	27.00
MRF455A	60W	12.00	27.00
MRF458	80W	18.00	40.00
MRF460	60W	16.50	36.00
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MRF240	40W	16.00	—
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Hunt the Auto-Fox

Has your transmitter-hunting gone sour? DFers will love chasing this wily box, and its variable skill levels give them a run for their money.

Many radio clubs across the country participate regularly in hidden-transmitter hunts. The Pikes Peak Radio Amateur Association, for example, has a fox hunt once a month, with each month's winner play-

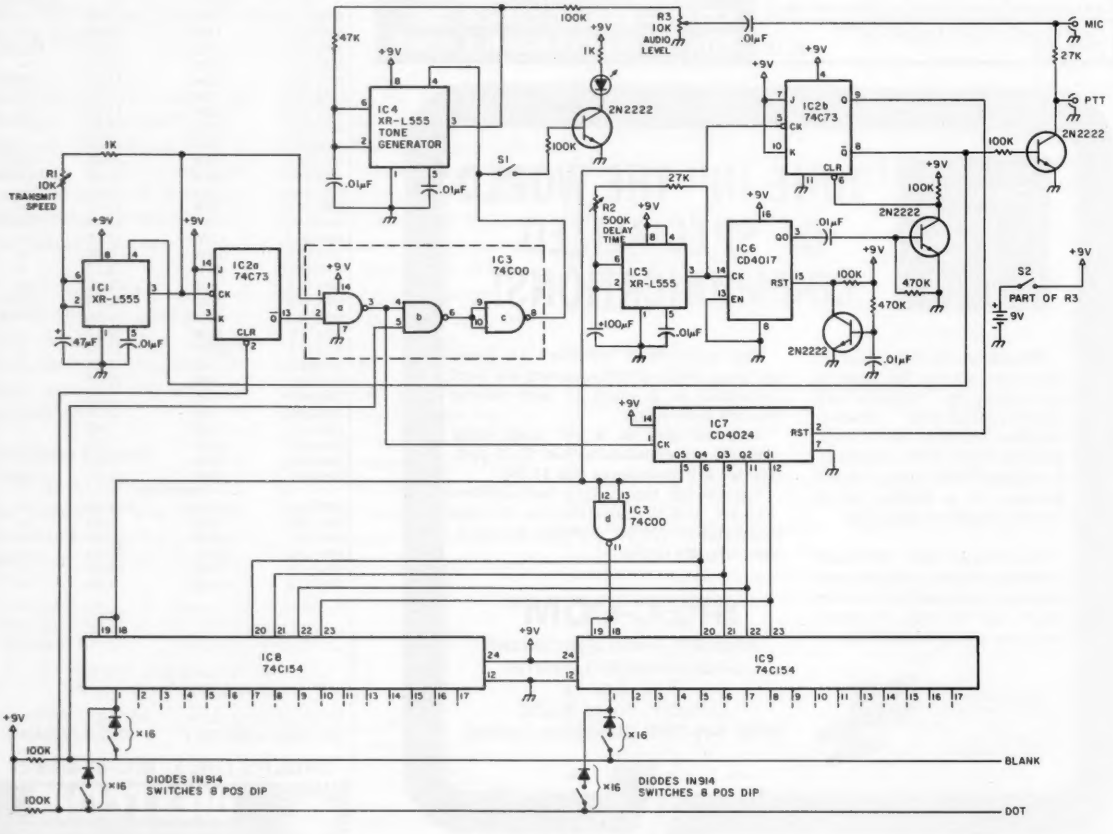


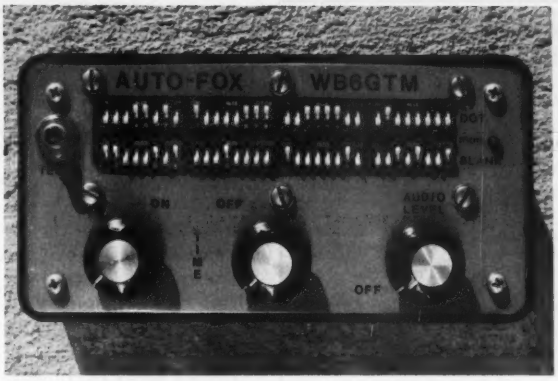
Fig. 1. Schematic.

ing the role of the fox the following month. When he/she is in place, the rest of the participants begin the hunt from a predetermined meeting area. The new winner is the person who finds the fox after traveling the shortest distance.

This game is lots of fun, of course—at least for the participants. However, the fox usually becomes quite bored with the whole process while sitting in a car somewhere and transmitting for one minute out of every five.

This problem can be alleviated somewhat by the use of the Auto-Fox, a device which attaches to just about any transceiver and sends a preprogrammed callsign in code at intervals determined by the operator. Now the real fox can read a book at least, or listen to the radio, or even rag-chew on a different frequency without being interrupted every few minutes for a fox-hunt transmission.

Built with CMOS devices, the Auto-Fox draws about one milliamp of current and should run for many hours using a 9-volt transistor-radio battery as a power source. Any callsign can be programmed with the DIP switches on the front panel of the device, and the operator has full control over the length of transmission (10 seconds to 1 minute), the time between transmissions (1 to 12 minutes), and the audio level into the transmitter.



The Auto-Fox was built using point-to-point wiring on parts of a protoboard and put into a Radio Shack 270-233 experimenter's box. The top panel contains the callsign programming DIP switches, transmit speed, delay, and audio level/on-off pots, as well as the push-button switch which activates the monitor LED. The right side of the enclosure (not shown) has a subminiature mike jack, a miniature PTT jack, and an external power connector.

Circuit Description

The Auto-Fox is based upon a clever repeater IDer designed by K2OAW.* The circuit is designed entirely with CMOS and low-power 555 timers (Fig. 1) for operating currents of just over 1 mA when transmitting and just under 1 mA between transmissions. Logic designers call this a "counter-based controller" since operation is controlled by binary counter IC7 and its clock, IC1. The DIP switches on the front panel of the Auto-Fox allow the system to produce a dash when both switches are open for a particular count, a blank by turning off the audio generator, IC4, or a dot by increasing the count speed by bypassing IC2a. IC8 and IC9 allow for 32 counts, each of which can be programmed independently as a dot, dash, or blank. The Auto-Fox can produce the longest US callsign, which consists of 29 counts including the 5 blanks between characters. The 10k pot on IC1 allows a callsign to be transmitted in a minimum of about 10 seconds or up to a maximum of about 1 minute.

The interval between successive callsign transmissions is determined by IC5 and IC6. The decade counter at IC6 is used in a divide-by-ten configuration to allow smaller timing components on IC5; the decade counter also has a power-on start feature on pin 15, so the fox will begin a transmission cycle when first turned on. This feature also allows the user to transmit an ID at any time simply by turning the Auto-Fox off for a moment, then on again. The 500k pot on IC5 sets the time between transmissions from a minimum of about 1 minute to a maximum of about 12 minutes.

When the push-button switch on pin 8 of IC3c is pressed, the LED will turn on whenever IC4 is producing an audio tone during the transmission cycle. Of course, a momentary switch is used here to prevent inadvertent draining of the battery by extended LED operation.

The mike output of the Auto-Fox will provide a variable-level audio tone to the microphone input of the companion transceiver and is configured to provide the correct push-to-talk (PTT) logic to the ICOM IC series of handie-talkies as well. A separate PTT output also is provided by the Auto-Fox for other transceivers requiring this additional control signal.

Construction and Operation

Parts layout of the Auto-Fox is not critical, and just about any convenient arrangement can be used. I tried to miniaturize my design as much as possible and managed to put everything into a Radio Shack experi-

Parts List

Quantity	Type	Description
3	IC	XR-L555 (276-1718)
1	IC	74C00 (276-2411)*
1	IC	74C73
2	IC	74C154
1	IC	CD4017 (276-2417)
1	IC	CD4024
4	Transistor	2N2222 (276-2009)
64	Diode	1N914 (276-1122)
6	Capacitor	.01 μF (272-131)
1	Capacitor	47 μF (272-1027)
1	Capacitor	100 μF (272-1028)
2	Resistor	1k Ω (271-1321)
2	Resistor	27k Ω (271-1340)
1	Resistor	47k Ω (271-1342)
5	Resistor	100k Ω (271-1347)
2	Resistor	470k Ω (271-1354)
1	Pot	10k audio w/SPST SW (271-215)
1	Pot	10k linear (271-1715)
1	Pot	500k linear (271-210)
8	Switch	8-pos. SPST DIP (275-1301)
1	Switch	SPST push-button NO (275-1547)
1	LED	General purpose (276-026)

Radio Shack part numbers are in parentheses; other parts available from Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.

*Functionally equivalent to 74C00, but pin assignment differs.

*"A TTL Logic CW ID Generator," Peter A. Stark K2OAW, *73* Magazine, February and March, 1973.

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menter's box (270-233). However, unless you are an experienced builder, I recommend that you gain some working room at the expense of using a slightly larger enclosure.

If the Auto-Fox is to be used with only a single callsign, you may want to save the cost of the DIP switches and extra diodes by hardwiring the callsign to the 74C154 chips, using only the required diodes.

Unlike most sequential digital circuits, the Auto-Fox operates slowly enough so that you can see most of the logic transitions on a voltmeter, which makes troubleshooting substantially easier. You can also temporarily short across the push-button switch to activate the LED continually for a simple operational check.

Once the Auto-Fox is operating correctly, construct the proper patch cords between the unit and the mike and PTT (if applicable) connections of the companion transceiver. Use a receiver to verify correct operation of the complete system, and adjust the transmit time, delay between transmissions, and audio level as required. The Auto-Fox is now ready for the hunt!

Conclusion

Since any callsign may be programmed into the Auto-Fox, it may be tailored to the person who happens to be the fox on a particular hunt. As the hunters become more proficient, the transmit time may be decreased by increasing the speed of the ID, thus requiring a faster direction fix. Also, the time between transmissions may be increased to provide fewer opportunities for a fix.

The Auto-Fox should take some of the boredom out of being the fox and will provide a precise signal which can be programmed for just about any direction-finding situation. ■

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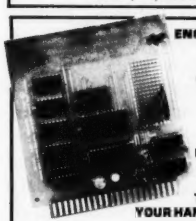

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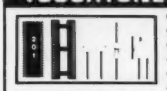

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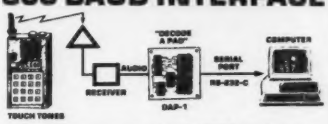

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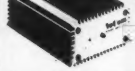

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Surviving the Unthinkable: Part III

WA8YKN outlines simple precautions that will allow your radio equipment to survive an electromagnetic pulse.

Editor's Note: Parts I and II of "Surviving the Unthinkable" appeared in the May and June, 1982, issues of 73.

Thomas M. Miller WA8YKN
936 Belmont Avenue
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One of the primary justifications for the very existence of amateur radio is emergency communications. Indeed, amateurs all over the world have volunteered their skills in times of need, and we can look with pride on our record to date.

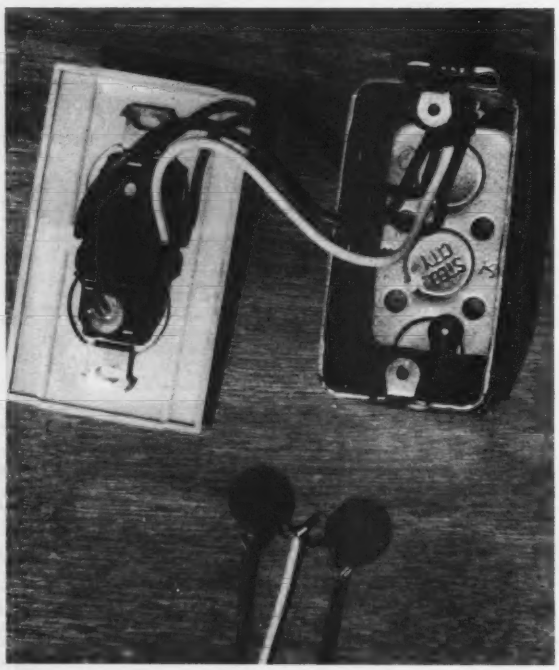

Photo A. Electric outlet with MOV spike suppressor properly installed. Below, two MOVs are connected in series for installation on a 220-volt line.

However, with today's ever-present nuclear threat, there exists a potential for the greatest communications disaster ever imagined, and there is a very great possibility that this time amateur radio might not be able to do the job. The danger to commercial, military, and amateur communications is EMP, electromagnetic pulse.

When a nuclear bomb is detonated, electromagnetic energy is released across the entire spectrum, from extremely low frequency up through radio frequency, infrared (heat), and right on through visible light to gamma rays. This massive release of broad-spectrum energy can cause large-scale disruption of radio propagation.

However, the situation could be much worse. If the device were detonated above the atmosphere, say 300 miles or more, the high-energy gamma rays released in the first split second of the explosion would crash into the molecules of the upper atmosphere, knocking electrons loose. These electrons would be gathered up by the earth's magnetic field, where they would be deflected to the planet's surface. The result is a discharge of extremely high voltage which finds its way to ground through any conductor available, much like a bolt of lightning does.

Just as lightning striking an antenna will destroy a radio on its way to ground, the high currents generated in cables, overhead wires, antennas, and other conductors can destroy electrical equipment connected to them. This can cause loss of electrical power, telephone service, and other serious problems. But the EMP isn't through yet. The large current flowing through all these conductors to ground generates a huge electromagnetic field, and that's the real problem for solid-state electronics, amateur radio included.

When an electromagnetic field collapses, it will generate *induced* current in any conductor which happens to "cut" its lines of magnetic force. The magnitude of the induced current is proportional to the intensity of the field that created it.

The field intensity of an EMP caused by a nuclear device of moderate size exploded above the atmo-

sphere can reach 50,000 volts/meter in the first ten billionths of a second.

The problem to radio amateurs is clear. The initial voltage pulse from either the ac power line or from the antenna and feedline can destroy an amateur-radio station. And even if the antenna and power are disconnected, the currents induced by the collapsing magnetic field into the very circuits of the radio gear can destroy transistors and integrated circuits with ease.

The similarity between the effects of EMP and lightning are striking (pun intended). However, while a lightning strike might damage some equipment in the general area, the EMP from a nuclear blast would cover a much larger area. In fact, if the device were detonated around 400 miles above the central US, the resultant EMP could damage equipment over most of the country! Imagine lightning striking every power line, radio tower, and telephone pole in the country *simultaneously* and you can begin to realize the extent of the EMP threat.

In 1962, during a series of high-altitude weapon tests, a 1.5-megaton bomb called "Starfish" was detonated 250 miles above Johnston Island in the Pacific Ocean. Instantly, lights winked out and burglar alarms rang all over Hawaii, over 600 miles away! Such an effect from so small a device was unexpected and began the first real look into the EMP problem.

No one is more concerned about EMP than the military. Since the Nuclear Test Ban Treaty prohibits atmospheric tests, a way had to be found to simulate the effects so that various protective measures could be evaluated. One such EMP simulator is "Trestle," located at Kirtland AFB in New Mexico. Trestle has a platform twelve stories high which can support a B-52 bomber. In order to simulate a free-space condition, the entire structure is made of wood! 250,000 wooden nuts and bolts hold the structure together. Trestle can generate five million volts which is discharged through antennas surrounding the structure.

The results of tests at Trestle and other simulators seem to indicate that the actual effect of EMP is pretty hard to predict. In fact, in a study by the National Research Council Committee, it was found that the effects of EMP often varied from predicted results by as much as 100:1 in either direction!

Even though test results have often been unpredictable, enough data has been gathered to suggest that there is much that we, as amateurs, can do to protect our equipment from the effects of EMP. It is important that we take these steps if amateur radio is going to be of any value in the event of an EMP emergency. Let's take a look at the typical amateur station and see what can be done.

Power lines: The best bet for ac power is to supply everything from a single fused disconnect located at a convenient spot in the room, to be used as a "master switch." This way the station, when not in use, would not be vulnerable to large spikes propagating down the ac line.

To offer some protection while in use, a transient suppressor such as a GE-MOV (General Electric metal-oxide varistor) should be installed from each ac line to ground at the disconnect. An additional MOV should be installed across each outlet into which the equipment is plugged. (See Photo A.)

Another source of trouble here is the three-wire cord. These things are fine to prevent your toaster from electrocuting you if it should develop a short, but on radio equipment they are an invitation to ground loops, and in the event of an EMP or lightning strike, currents can be induced from the ac line to the third "ground" wire, causing large circulating currents in the chassis itself. That brings us to the next point.

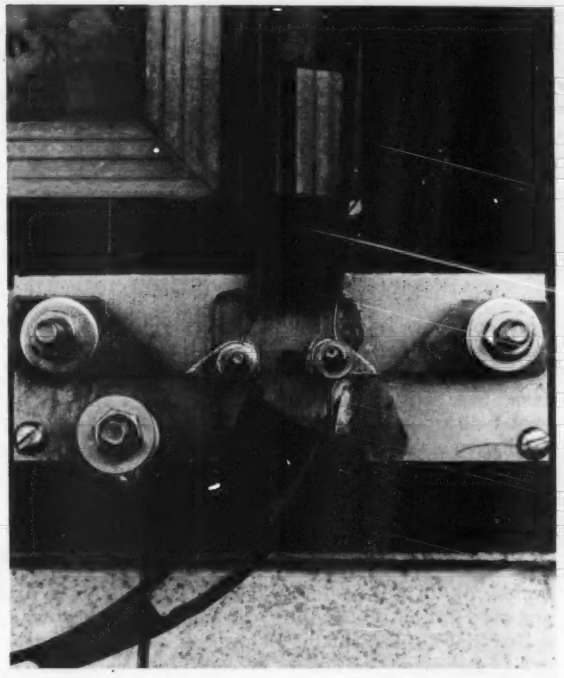

Photo B. A simple home-brew high-voltage discharge gap for open-wire feedlines.

Grounding: If we are going to spare our equipment from EMP, we have to offer it something more attractive. We need the *best* ground we can possibly get. The standard eight-foot copper ground rod is a good starting point. Even better is several ground rods several feet apart joined together by a heavy (#8 or larger) wire just below the surface. The ground should be located near the equipment so that the connecting wire is as short and straight as possible.

Many amateur stations are located near a window to provide easy ingress of feedlines, and this is an ideal place for the "station ground." Mount a plate of 1/4-inch aluminum to the windowsill and connect it directly to ground. Now *all* equipment in the shack is connected *individually* and *directly* to the ground plate using #8 aluminum wire. The cold water pipes, the tower base, the neighbor's chain-link fence, in short all the various large metal objects that hams are known to hook into the ground system, should all be connected to the common ground plate. Everything connects to *one point!* This is why we cut off all the grounded plugs in the previous step. Does your house have aluminum siding? Ground it! Not only will it provide lightning protection, but it will also provide a degree of shielding.

Feedlines should each be provided with a good lightning arrestor at the point where it enters the house. Coaxial feedlines can use the arc-gap type, such as the Cushcraft "Blitz-Bug" or something similar. For open-wire line or twinlead, a simple arc gap can be made

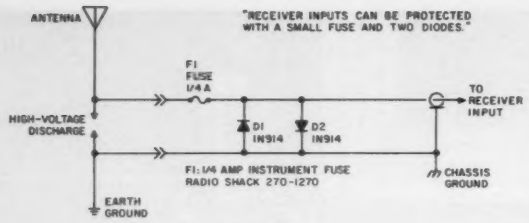

Fig. 1.

from copper or aluminum. (An example is shown in the *Radio Amateur's Handbook*. See Photo B.) Whatever type of suppressor is used, connect it directly to the station ground.

Even with the lightning arrestors, it's a good idea to ground all feedlines when not in use. The rotary switch commonly used to select coax-fed antennas usually will ground all inputs but the one in use. Open-wire feedlines can be grounded with a large knife switch.

Feedlines can also be fused with fast fuses such as the Buss ABC type. The input to a sensitive receiver can be protected with a 1/4-Amp fuse such as the kind used to protect the input of a delicate volt ohmmeter. Back-to-back diodes should be added across the antenna terminals to shunt the pulse to ground, blowing the fuse before the receiver is damaged. (See Fig. 1.)

If the equipment in your shack is tube-type, the above steps may be all that is needed to offer reasonable protection from EMP. Once we've provided a good ground and shunted off the primary surge, tubes are usually quite capable of withstanding the voltages induced in the circuits by the collapsing field of the EMP. However, if your equipment is solid state, you may have to look at the final category in our EMP protection plan.

Shielding: The field generated by the EMP will not cause current to flow in the circuits of our equipment if we prevent the magnetic lines of force from reaching those circuits. Many commercially produced transceivers on the market today are very well shielded. Some are not. This will have to be determined on a case-by-case basis. Things to watch are seams and cracks in cabinets, and jacks for connecting cables. The "Construction Practices" chapter of the *Radio Amateur's Handbook* gives practical information on making radio equipment truly rf-tight.

As we look back over all the above steps to protect our equipment from EMP, one fact stands out clearly: *All of the steps are extensions of normal amateur practice!* There is nothing secret or exotic here, not even anything difficult or expensive. In fact, if you read the building codes governing radio stations, you will probably find that most of these switching and grounding techniques are *required by law!* But even though we all know about proper grounding, lightning suppression, etc., how many amateurs have taken the time to do the job right?

By taking the steps outlined above, we can stand a much better chance of providing the service our neighbors expect of us should the electromagnetic pulse ever threaten our normal communication channels. At the same time we will be making our amateur-radio stations better organized, less likely to cause TVI, and above all, safer! ■

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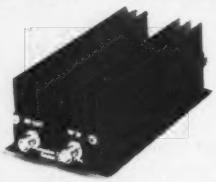

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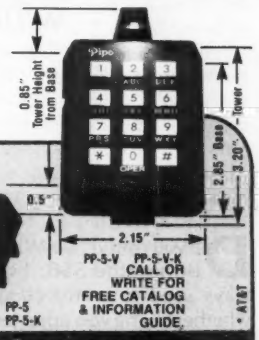

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Scope That Signal

Are you overmodulating? Is your linear linear? Find out with a station monitor you've built from scratch.

Do you worry? I do. When I operated SSB, I always used to worry about whether my rig was adjusted properly to put out the best possible signal. My rig, like many transceivers today, uses a linear stage for the final amplifier regardless of the mode of operation, be it SSB or CW, and the only instrumentation provided is the ubiquitous panel meter. In addition, I had a directional coupler for measuring forward power and vswr. With this arrangement, tuning up for CW is no particular problem: Just put the key down, keep the plate current more or less dipped (it's a vacuum-tube final), watch the forward-power meter, and tune for maximum smoke (that is, forward power) while not exceeding a certain maximum allowable value of plate current.

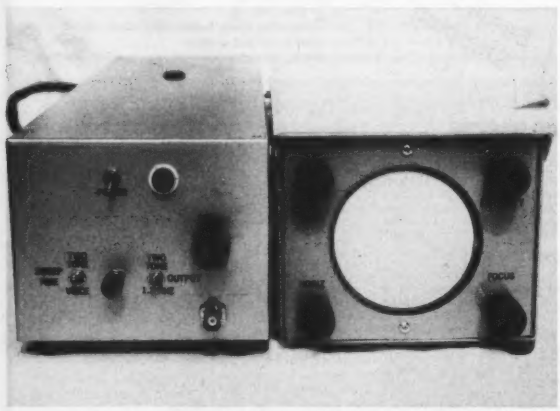

Photo A. The monitor scope is built in two enclosures. The one on the left contains the power supplies and the main circuitry.

With SSB (and to a lesser extent AM, assuming there is anybody out there still running AM) the problem is not so easy, however. Since panel meters can't respond to the instantaneous changes in the transmitter during modulation, an oscilloscope must be used for monitoring the true state of the transmitted signal. Some fine monitor scopes designed specifically for amateur use are available commercially, but the prices are rather steep. Consequently, most of us fall back on the time-honored procedure of setting the rig to the Tune position, putting out a single CW note, and tuning for maximum forward power. When the rig is switched back for SSB modulation, we just hope everything will come out OK. Nevertheless, this still leaves unanswered the question of whether the rig is properly tuned up. Being the sort who worries endlessly about such little questions, I used to sit there and worry.

This state of affairs persisted up until August, 1983, when the FCC finally changed the rules on maximum allowable power for the Amateur Radio Service. Whereas previously we were limited to 1-kW-dc *input* power with no limit on output power, now we have a 1500-Watt limit on PEP *output* power with no limit on dc input power (except for AM DSB which temporarily remains unchanged). In order to most effectively utilize the new rule, we now need the ability to make accurate output-power measurements for all modes of operation. An oscilloscope nicely meets this requirement. Consequently, I finally came to the decision that I had to have a monitor scope. With the prices of the commercial units making them out of the question for me, I would have to build one.

What follows is a description of a monitor scope that is relatively easy to build and that is cheap. The whole cost was less than $50.00, exclusive of the price of the

CRT (which was already on hand, having been obtained many years previously by a method so unlikely as to be quite unbelievable). The device includes a built-in two-tone signal generator and a two-speed linear-sweep generator, one sweep speed being used for examining the two-tone test pattern (or just a single-tone pattern for AM rigs) and the other speed being used for examining voice patterns during normal station operation.

While most readers will not wish to duplicate the unit in its entirety (especially the toroidal transformer for the horizontal-sweep voltage), the main circuitry is so straightforward that it should serve as an excellent starting point for those wishing to build their own monitor scope. Those who already have a general-purpose oscilloscope equipped with an external input to the horizontal amplifier (which also provides, or can be adapted to provide, a direct connection to the CRT vertical-deflection plates) will need to build only the main circuitry and the low-voltage power supplies to obtain a first-class scope.

General Description

Fig. 1 is a block diagram of the monitor which illustrates the key features of the unit. A 12-kHz pulse generator is the initial source for each of the two sine waves used for the two-tone signal (1200 Hz and 2000 Hz) and it also is the source for the trigger pulses for the CRT sweep waveform. The 1200-Hz sine wave is derived by digitally dividing the 12-kHz pulses symmetrically by ten, and then passing the resulting square wave through a 700-Hz low-pass active filter. The 2000-Hz sine wave is similarly derived, except that the division is by six and the low-pass filter has a cut-off frequency of 1100 Hz.

The two sine waves are then linearly added in a strobed adder circuit driven by a separate asynchronous pulse generator running at about 10 Hz. By adjusting the duty cycle of the asynchronous pulse generator to approximately 33%, the resulting pulsed two-tone test signal can be continuously applied to the transmitter under test without exceeding the transmitter's maximum dissipation limits. At the same time, the CRT display appears to be continuous and can be examined at your leisure. While the trick of pulsing the two-tone test signal is not new,[1, 2] its use has not appeared in the literature for a long while; it is a technique worth remembering. Provision is also made for running the adder continuously; in this manner the PEP dc input power may more easily be determined (see below).

Besides generating a two-tone test signal, the monitor also can provide just the 1200-Hz sine wave as a test signal for use with AM rigs. Since AM transmitters must have sufficient dissipation capability to run with continuous modulation, the 1200-Hz signal need not be pulsed.

In addition to the sine waves, the trigger pulses for the sweep generators are also derived by digital division. The 2000-Hz square waves are further divided:

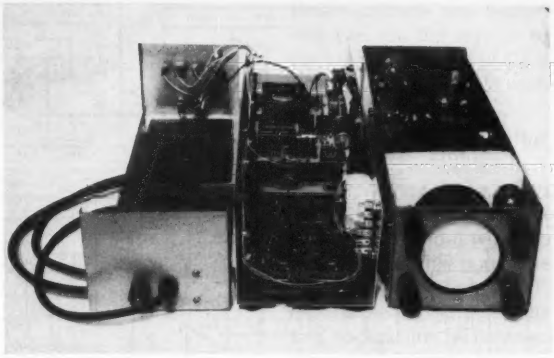

Photo B. Interior view of the monitor scope. The power supplies are at the rear.

by ten to provide 200-Hz pulses for triggering the 4-ms sweep generator, and by 60 to provide 33-1/3-Hz pulses for triggering the 24-ms sweep generator. The 4-ms sweep displays 3.2 complete beats of the 800-Hz difference between the two sine waves, while the 24-ms sweep is a convenient speed for viewing voice patterns.

It is important to note that by this choice of division factors (2, 5, and 6), the 4-ms-sweep repetition rate of 200 Hz is an exact submultiple of both of the sine waves; and since all three waveforms are derived by digital division of one common oscillator, the relative phases of the three waveforms are fixed and cannot change even if the 12-kHz oscillator drifts in frequency. In this manner an unconditionally-stable CRT display is produced without the complication of involved level-sensitive trigger circuits such as are found in the normal measurement oscilloscope. The 24-ms-sweep divisor chain, while mainly intended for voice-pattern observation, also contains the same division factors; it, too, will produce a stable two-tone pattern if desired. Similarly-stable AM-envelope test patterns are also produced.

Main Circuit

The main circuitry which forms the heart of the monitor scope is shown in Fig. 2. A 555 timer, U1, is the 12-kHz pulse generator, with R1 providing fine frequency adjustment. The exact values shown need not be used, but all resistances and the

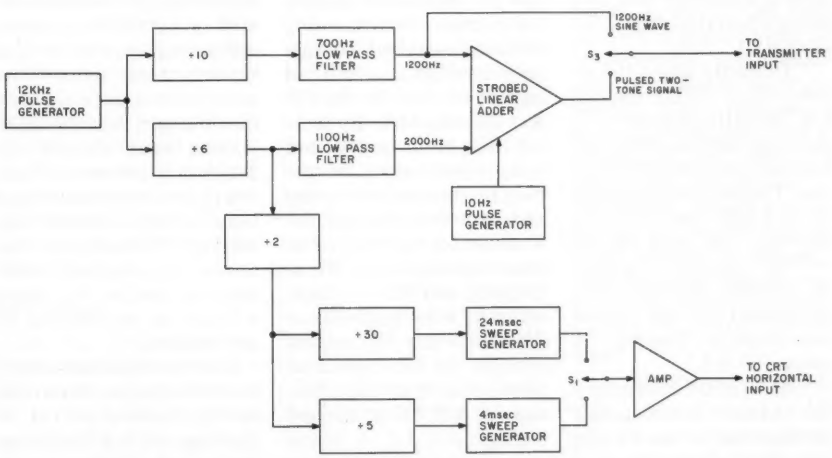

Fig. 1. Block diagram.

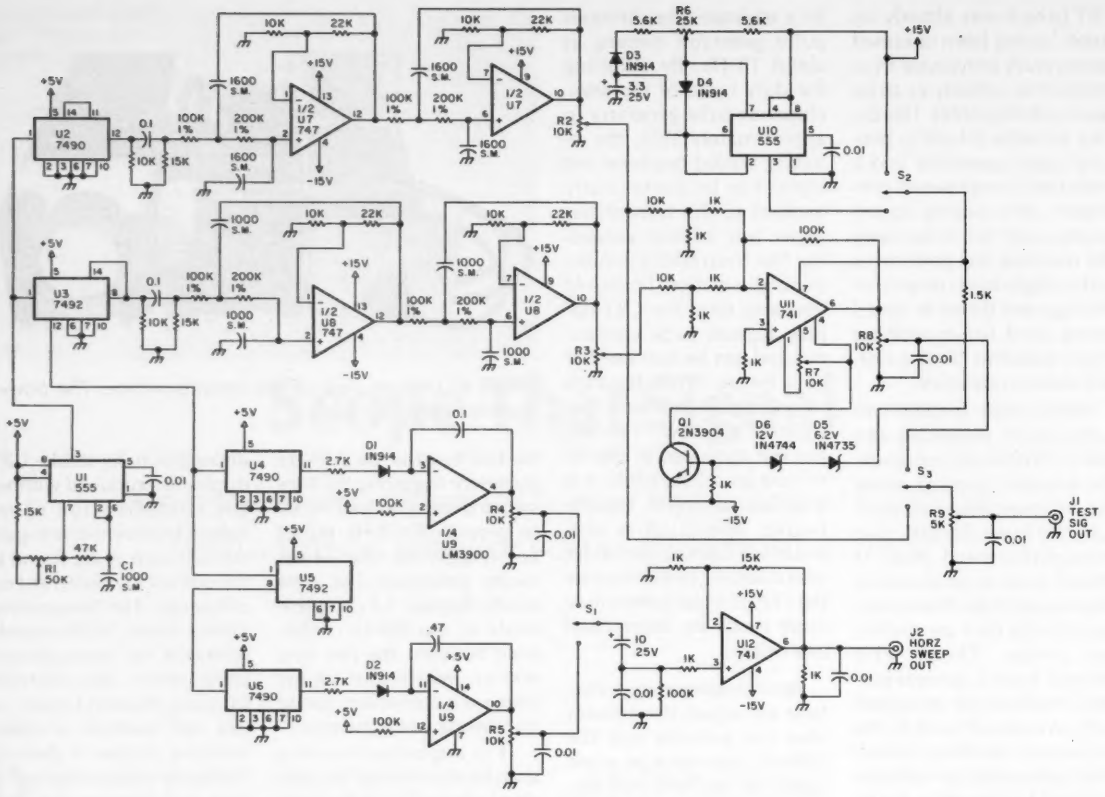

Fig. 2. Main circuitry.

value of the timing capacitor, C1, must be changed proportionally if the 12-kHz oscillation frequency is to be maintained. Although drift in the oscillator frequency will not cause the CRT display to change, a capacitor with good stability, such as a silvered mica or a polycarbonate, should be used at C1.

U1 directly drives the divider chain of U2 through U6. Initially, regular TTL packages were used, but the current consumption was over 150 mA, which proved to be a little too much for the heat sink used on the +5-V-dc regulator. Low-power Schottky devices were substituted and the current consumption dropped to around 65 mA.

The 1200-Hz square waves from U2 are applied to the input of the 700-Hz, two-stage, active low-pass filter formed by U7, while the 2000-Hz square waves from U3 are fed to the 1100-Hz filter formed by U8. In this case, type-747 packages (dual 741s) were used, but individual 741s may be used if desired (or a single LM348—quad 741s—can be used if obtainable). Both of the filters are implemented using the op amps as non-inverting voltage-controlled voltage sources with a passband gain of two (set by the 10k and 22k resistors). By picking the gain to be two and using equal values for the two frequency-determining capacitors in each stage, the formulae for the required resistances simplify to R1 = $Q/(2\pi fC)$ and R2 = $R1/Q^2$, where R1 is the input resistor (100k) and R2 is the resistor between the two capacitors (200k). The Q of the filters was set at 0.707 to prevent ringing.

Again, there is nothing sacred about the exact values used, and the ones shown here were picked entirely as a matter of convenience from parts on hand in the junk box. Thus the gain-setting resistors could just as easily have been 4.7k and 10k, or 22k and 47k, etc. If a capacitance value other than 1600 pF is desired, the 100k and 200k 1% resistors can be replaced according to the formulae above. However, resistance values much larger than the 200k shown here should be avoided to prevent difficulties caused by the op amp's input offset currents. Although 1% resistors are shown, 5% values can probably be used in the filters without any serious loss in performance.

The recovered sine waves from the low-pass filters are linearly added in U11. A package with a single op amp is required here to allow strobing. Stage gain is set for 100 to prevent an objectionable amount of signal feedthrough when power is not applied to the adder. The signal level out of the low-pass filters is about 1 volt peak. To prevent saturation of the adder, the level-setting pots, R2 and R3, attenuate the tones by a factor of ten; a further reduction is achieved by the 10-to-1 dividers between the pots and the input to the adder.

The 10k pot, R8, on the output of the adder allows the two-tone signal to be attenuated to the level of the 1200-Hz sine wave so that if you want to switch between the two-tone signal and the 1200-Hz sine wave when testing, the signal level to the transmitter remains the same. Either the two-tone signal or the straight 1200-Hz sine wave is selected by S3, and the level to the transmitter is set by R9.

A second 555 timer is

used for the asynchronous 10-Hz pulse generator that provides the strobed power for the adder; either these pulses or continuous power may be selected by S2. Use of the two blocking diodes, D3 and D4, divorces the charging-current path from the discharge-current path to allow duty cycles less than 50%. Equalizing zener diodes D5 and D6 provides the base drive for the V-strobe transistor, Q1, or a single zener in the 18-to-24-volt range could be used if available.

Two separate CRT sweep generators were built, each using 1/4th of an LM3900 package with the sweep speed being selected by S1 (the remaining two quarters were not used). Sweep time is determined by the capacitors, and it was felt that it was best not to put the selection switch in the capacitor circuit. Since the LM3900 operates from a single-ended supply, the sweep voltage is always positive and a blocking capacitor has to be used before the following amplifier to remove the dc component of the sweep waveform.

The leading edge of the trigger pulse from the divider chain sets the generator output low, and then the output starts rising linearly as soon as the trigger pulse goes low. The output continues to rise until maximum supply voltage is reached, at which point the generator locks up until the next trigger pulse resets it.

Consequently, to produce a linear sweep with no high-level dead time, the interval between trigger pulses must be less than the maximum available charging time for the capacitor. As long as this criterion is met, sweep time will be determined by the interval between trigger pulses and not by the value of the capacitor, *per se*. However, if the maximum available charging time is very much longer than the interval between trigger

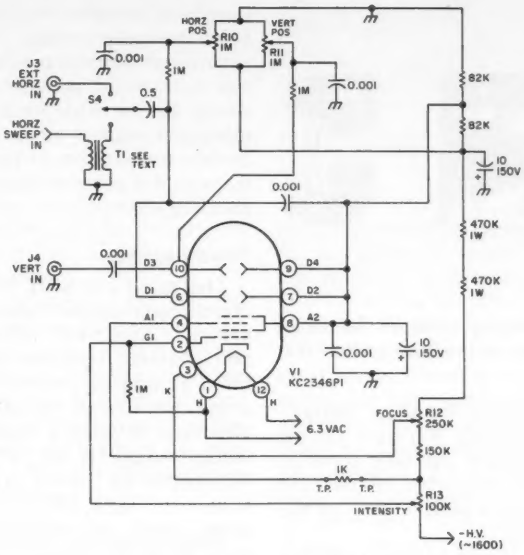

Fig. 3. CRT circuitry.

pulses, relatively little sweep voltage will be developed. Hence, for a given trigger-pulse interval, some reasonable capacitor value must be chosen. The values shown are about optimum for the trigger pulses used here, and the sweep-generator outputs are each about two volts peak. Equalization of CRT sweep widths are obtained with R4 and R5, and a sweep output of about 20 volts peak is produced by the U12 amplifier stage following the generators.

As mentioned previously, the circuit of Fig. 2 is all you'll need if you already have a general-purpose oscilloscope that has its own built-in horizontal amplifier and direct access to the vertical plates. If you fall into that category, you can skip the next section and go look at the power supplies. But if you want to start from scratch with just a CRT, the next section will show you how to do it.

CRT Circuit

In Fig. 3 you can see what's needed to hook up a CRT to get a usable trace. It's a simple circuit and is basically taken straight from any copy of *The Radio Amateur's Handbook* between 1962 and 1980. (I presume it's in later editions also.) All resistances are 10%, and all wattages are 1/2 Watt, except for the two 470k, 1-W resistors. There are a few changes from the basic *Handbook* circuit that are worth noting here:

Since the high-voltage supply I built provided 1600 volts, the voltage divider chain was adjusted to draw 1 mA at this voltage. I then picked the 100k and 250k pots and the 150k dropping resistor to roughly match the recommended range of operating voltages specified by the data sheet for the DuMont KC2346P1 CRT. This tube has a deflection sensitivity of about 25 to 30 volts per inch, so the 82 volts of plus-or-minus dc voltage on the plates guaranteed that the trace could be moved anywhere on the face of the screen. I'll give you 100-to-1 odds that you won't be using this particular CRT, but the adjustment range can easily be changed by altering the 82k resistors for any CRT you happen to have.

Don't forget to include the 1-M resistor that ties the heater to G1. Most CRTs aren't built to have more than about 150 volts between cathode and heater. You can run the resistor to the cathode instead of G1 if it's more convenient with your particular tube.

You will also note a .001-uF disc ceramic across the horizontal-deflection plates. This capacitor helps keep rf off these plates, and it will help extend the usable upper frequency limit of the CRT. Mount the capacitor on the CRT socket directly between the terminals for the horizontal plates to get the maximum possible benefit.

The 1k resistor, in series with the cathode, is used to measure beam current to verify that you are not drawing excessive current from the electron gun. The current is determined by *carefully* measuring the voltage drop across the resistor. Be *extremely* careful if you do this, because the whole meter and its leads will float up to almost the full value of the high-voltage supply. A shock from a 1600-volt supply is always a very serious matter, if not a fatal one.

Now comes the problem of how to get the necessary horizontal-deflection voltage to sweep the CRT. The DuMont tube was a three-inch tube, so it required something like 100 volts of sawtooth to sweep it. Some of the older and more common CRTs, like a 3AP1 or a 5BP1, have deflection sensitivities as low as 150 volts per inch, or worse. With one of these tubes, 500 or more volts of sawtooth might be needed. Sweep voltages of this magnitude are difficult to produce with common solid-state components—and besides, I didn't want to include yet another supply in the monitor. So instead I built the sweep transformer, T1, winding it on an Amidon FT-193-J toroidal ferrite core.[5]

Without going into the theory of transformer design, I want to point out two requirements that had to be met: First, there had to be

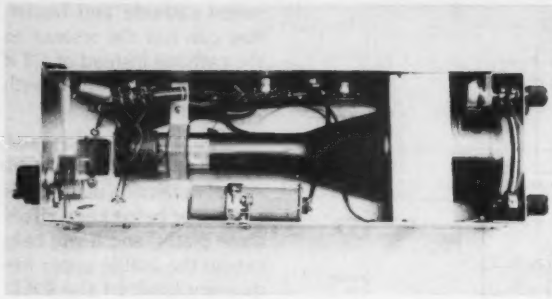

Photo C. Details of the CRT mounting. Note the clamps on the neck and the styrofoam block on the body of the CRT.

enough turns on the primary to avoid saturating the core, and second, the self-inductance of the primary had to be high enough to present a reasonably high impedence to the driving source. After a great deal of fiddling around, I determined that with this core, 200 turns on the primary would be enough for the fast sweep speed, so when I wound it, I used 300 turns to be safe.

For the secondary, I used 4500 turns to obtain a 15-to-1 step-up transformer. Since the U12 amplifier stage put out about 20 volts, I ended up with about 300 volts of peak sawtooth which was more than enough for the DuMont tube. However, at the slow sweep speed the core would saturate before a full-screen sweep could be obtained, so I had to limit myself to about 2.5" of deflection for voice patterns. Probably 400 turns on the primary and 6000 turns on the secondary would have been a better choice for this core.

Let me hasten to add that I had access to a toroidal-coil winding machine and I did not wind T1 by hand. Amidon now offers ferrite E cores which come in two halves, and with these cores a bobbin can be wound normally using an electric drill. This is a much more practical procedure for home construction. For anyone wishing to try an E core, I would recommend using one of the larger sizes rated for 100 to 200 Watts when used as a power transformer.

Another way to obtain the sweep voltage, of course, is to build a several-hundred-volt supply and use a vacuum-tube amplifier to develop the sweep voltage.

However the sweep voltage is obtained, provision should also be made for an external horizontal input to enable production of the trapezoidal pattern when checking AM rigs.

Power Supplies

The main circuitry requires power supplies to provide +5 volts, +15 volts, and −15 volts. If you plan to build a complete monitor scope from scratch, you will also need at least a high-voltage supply for the CRT. The supplies I used are shown in Fig. 4, which is pretty much self-explanatory. With the choice of windings as shown, transformer T3 is rated by the manufacturer to produce a nominal 34 V ac across the whole secondary. Any center-tapped transformer in the range of 30 to 40 volts and 25 mA or more should be satisfactory.

You can be quite flexible in the design of the high-voltage supply since most CRTs will work with anything from 1 kV to 2 kV or perhaps a little higher, depending on the tube. Check the manufacturer's data sheet or the tube tables to determine the maximum operating voltage, and then pick about 60% to 75% of that. Try to stay above 1 kV to get enough brightness. It's quite annoying if you have to turn off the room lights to see the trace clearly.

In this case, I was able to find at a local electronics surplus store a CRT transformer that matched my requirements very well: This transformer provided 1600 volts for the CRT, which was nearly optimum. Besides producing the correct voltage, be sure to use enough filter capacitance to keep the ripple low, otherwise hum will show on the trace. The exact value of capacitance needed will depend upon the current drain from the supply, the voltage sensitivity of the CRT deflection plates, and the electron gun focusing. In this scope, 1 mA flows in the equalizing resistors across the rectifiers, 1 mA flows in the voltage divider chain, and the CRT electron gun draws about 0.5 mA. Initially I used only 0.15 uF for the filter, and it wasn't enough. The measured ripple was 20 V rms.

The effect of the hum did not appear as a 60-Hz sine wave or as a general fuzziness of the trace as you might expect (I did!). Rather, with the sawtooth sweep applied to the horizontal plates, the effect was such as to produce a vertical pattern on the trace that approximately looked like the sawtooth waveform itself. However, since the sweep frequency was not related in any way to the line frequency, the trace was constantly rotating. This was very confusing. When I finally realized it was the effect of ripple, I added a 2-uF oil-filled capacitor from the junk box (that was marginally ok, but 10 uF to 20 uF would have been better).

One last warning: *Be Careful!* Supplies at this voltage require constant vigilance.

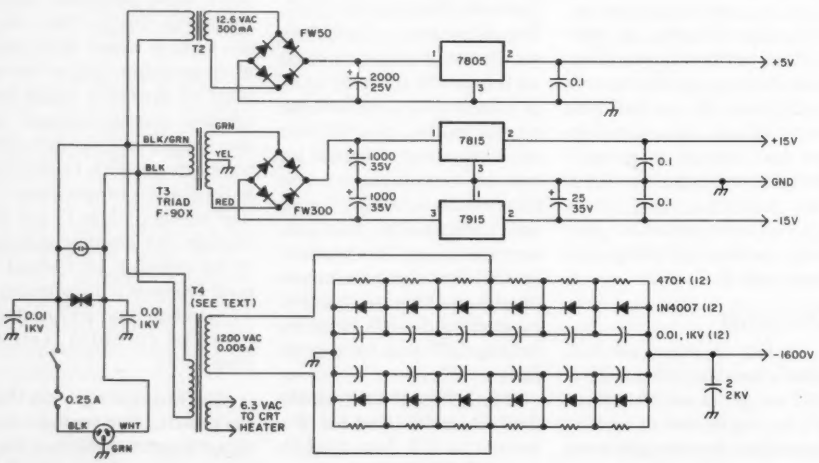

Fig. 4. Power supplies.

Construction

Construction of the moni-

tor scope is straightforward. As shown in Photo A, the unit was assembled in two separate enclosures, one for the CRT and its associated circuitry of Fig. 3, and a second one for the remainder of the circuitry. The two enclosures were connected by a heavily-shielded cable. In this manner, the CRT was kept far away from the stray fields of the power transformers which otherwise could have blurred the oscilloscope trace. Point-to-point wiring was used in the CRT enclosure, while perfboard construction was used in the other. All ICs, U1 to U12, were mounted with sockets on the perfboard.

Mounting the CRT is a little tricky because of its fragility. The method used here is shown in Photos B and C. A screen was made of hard clear plastic by inscribing a centimeter graticule with a ruler and a sharp point. This screen was placed directly inside the enclosure over the opening for the CRT face. The face of the CRT was placed against the screen, and the CRT was supported on its large front diameter by cutting a tight-fitting hole for the CRT in a block of styrofoam® that was in turn fitted to the inside enclosure.

The neck of the CRT was captured and supported by two V-brackets made of aluminum strip. The brackets clamped the neck of the tube from above and below. Before clamping, a piece of rubber from an inner tube was placed around the CRT neck to prevent direct metal-to-glass contact. In this manner, the neck could be gripped quite securely without damage.

Special care in mounting was also needed for potentiometers R12 and R13, the focus and intensity adjustments, respectively: As can be seen in Fig. 3, these controls float at high voltage. They were mounted on a small piece of hard plastic, and insulating couplings were used to couple the shafts to the knobs on the outside.

No other additional precautions have to be taken other than to use good engineering practice when wiring the CRT HV supply, and to use leads as short as possible for bringing the rf to the hot CRT vertical-deflection plate.

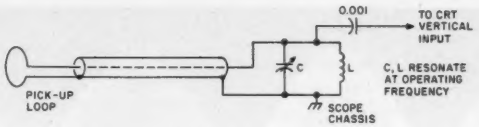

Fig. 5. Coupling rf to oscilloscope.

Adjustment and Checkout

If a general-purpose oscilloscope is available, it will be very useful for checking the operation of the main circuitry (although you can get by without one). If you can borrow one for the adjustment, it will be worth the effort.

Build the power supplies and get them working first; then start on the main circuitry. I found it useful to build one functional block at a time and check it out before I went on to the next. This method seems to make troubleshooting easier. If some method of checking frequency is available (e.g., a calibrated oscilloscope), adjust R1 to produce 12-kHz pulses from U1; otherwise set R1 to the middle of its range. Check for output from U2 through U6 to verify proper operation of the frequency divider chain.

Temporarily remove U7 and U8 from their sockets. Set S2 for application of continuous power to U11, and then adjust R7 for zero output on pin 6 of the 741. Reinstall U7 and U8 and then adjust the outputs from R2 and R3 for approximately 0.5 volts peak each. Adjust the output from R8 to equal that from R2. If an oscilloscope is available, adjust R6 to produce a 33% duty cycle in the U10 oscillator. If an oscilloscope is not available, this adjustment can be accomplished later when the two-tone generator is finished and an amplifier is under test by observing the plate current drawn by the final when driven by the pulsed two-tone signal: Adjust R6 until the current drawn is 1/3 of that drawn by the final when S2 is momentarily set for a continuous two-tone signal. Remember to use a dummy load since there is enough garbage on the air already!

Finally, after the main circuitry is driving a CRT, R4 and R5 can be adjusted to produce the desired sweep widths across the face of the CRT. R9 is most conveniently adjusted after the monitor scope is connected to the transmitter. It is set to produce a signal-level output equivalent to the output of the microphone used with the rig.

Coupling Transmitter to Oscilloscope

If a general-purpose oscilloscope is used, connection must be made directly to the CRT's vertical-deflection plates, unless the oscilloscope's vertical amplifier has a bandwidth great enough to pass the transmitter's output frequency, in which case the normal vertical input can be used. (But be careful not to blow out the vertical amplifier by applying too much power.) The horizontal sweep from the main circuitry's sweep generators can be fed to the oscilloscope's external horizontal input. Depending upon the power level of the transmitter and the deflection sensitivity of the CRT, various methods can be used to apply the rf signal to the vertical plates.

Methods that use a parallel resonant LC circuit connected to the CRT plates and a pickup loop coupled to the transmitter will work with very low power levels since the resonant LC circuit can develop a large rf voltage in spite of the power level. Fig. 5 illustrates this method. The pickup loop can be placed anywhere in the system beyond the point where any adjustments are to be made. Typical locations are a dummy load, an antenna tuner (transmatch), or often the transmission line itself.

If the power level of the transmitter and the deflection sensitivity of the CRT are well matched, sometimes merely a simple tee fitting can be inserted in the transmission line. The signal available at the arm of the tee can be applied directly to the vertical input to the oscilloscope through a blocking capacitor. At high power levels, the center conductor of the stem of the tee can be removed and replaced by a short stub which couples capacitively to the center conductor that remains in the cross arm of the tee. Modified tees of this sort can be constructed with different coupling coefficients for different power levels.

Transmitter Testing

With the oscilloscope coupled to the transmitter, the two-tone signal can now be injected into the transmitter through the mike jack. Set the transmitter's mike-gain control to its normal position for SSB operation, and make any required adjustments in input signal level to the transmitter with R9, the output-level control of the main circuitry. S2 can be momentarily set for continuous output while adjusting R9. On rigs with an ALC indicator, adjust R9 so that ALC activity just starts to occur; otherwise set R9 by whatever method is usually used to adjust the mike gain.

Be sure to use a dummy load out of courtesy to other amateurs. After setting R9, don't forget to return S2 to the pulse position.

With the two-tone signal being fed to the transmitter and the output dissipated in the dummy load, the envelope of the test pattern should be observed on the oscilloscope. Photo D is an example of what the display should look like. Examples of what the pattern should *not* look like can be found in the references as can be additional examples of correct two-tone envelope patterns.[4,6,7,8] If any deviation from the correct pattern can be seen by the naked eye, then the actual level of spurious products has already reached moderate levels.

In other words, by the time the human eye can notice distortion in the two-tone test envelope pattern, actual spurious output products as would be shown by a spectrum analyzer (IMD products as well as insufficient carrier suppression) have already reached an unacceptably high level of −25 to −20 dB down from the PEP output level.[4] Needless to say, if you can see any distortion in the two-tone pattern, adjustment of the transmitter and/or amplifier is necessary. Hopefully, you will be able to obtain the correct pattern of Photo D.

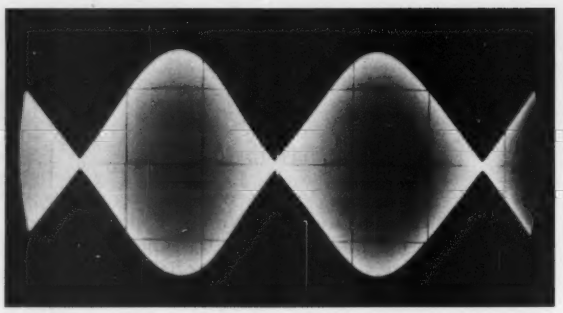

Photo D. Correct two-tone test pattern as displayed by the monitor scope. Coupling was by use of a tee in the transmission line.

Input Power Measurement

If S2 is momentarily set for continuous application of the two-tone test signal and the indicated dc input current is observed, the PEP input current being drawn can be calculated by: $I(PEP) = 1.571 \times I(dc) - 0.570 \times I(0)$, where I(PEP) is the PEP input current, I(dc) is the dc input current indicated by the meter, and I(0) is the resting current drawn by the final with no output signal. Apply the continuous two-tone signal only long enough to obtain the reading, otherwise you might overheat the final amplifier. Also, measure the supply voltage to the final while the continuous two-tone signal is applied. This is necessary because most supply voltages drop significantly under loaded conditions. The product of the loaded supply voltage and the PEP input current then give the PEP input power to the final amplifier under test.

Output Power Measurement

Besides checking for distortion, the oscilloscope is a useful instrument for measuring peak instantaneous output power. Remember that peak instantaneous output power is *not* PEP output power. PEP output power is the rms power of one complete rf cycle occurring during periods of peak modulation when transmitting SSB or under key-down conditions during CW operation. Note that as with other methods of measuring rf power, the transmission line must be properly terminated if accurate measurements are to be obtained.

If a convenient display that fills between 40% to 90% of the screen can be obtained with the direct-connection technique using a normal tee fitting in the transmission line, it is necessary only to calibrate the vertical deflection of the oscilloscope directly in volts per graticule division. PEP output power is then given by: $P = E^2/(2Z)$, where E is the peak instantaneous voltage as measured by the oscilloscope (1/2 of the total pattern height) and Z is the characteristic impedance of the transmission line. Calibration of the vertical-deflection factor can easily be obtained by applying 60 Hz ac to the vertical plates from an appropriate transformer. Be sure to measure the voltage with an ac voltmeter; don't rely on the rated voltage of the transformer. Remember that the voltmeter will almost certainly read the rms voltage, not the peak-to-peak voltage which is what the oscilloscope will display.

If one of the other indirect coupling methods is used, then there will be an arbitrary but constant factor relating graticule divisions to the peak-to-peak rf voltage displayed. One method of determining this calibration constant is to insert a calibrated rf wattmeter into the transmission line and measure the rf power delivered by the transmitter when set for normal CW operation. At the same time, note the height of the pattern on the oscilloscope screen. If the wattmeter reads average or rms power, then the peak instantaneous rf voltage is given by: $E = \sqrt{2PZ}$.

Alternatively, an rf ammeter can be inserted into the transmission line to measure the rms current, and then the peak instantaneous rf voltage is given by: $E = 1.414\ I\ Z$. Remember that these values must be multiplied by two to obtain the peak-to-peak value which represents the full pattern height.

Another method of determining the calibration constant is to measure the rf voltage developed across a dummy load with an rf voltmeter probe connected to a VTVM or other high-input impedance voltmeter; these rf probes usually are set up to measure rms voltage, and this value must be multiplied by 2.828 to obtain the peak-to-peak value.

Conclusion

Once the monitor scope is working properly and, if desired, it has been calibrated for output power, it can be left in the transmission line as a permanent indicator of correct station operation. The pulsed two-tone pattern can be used briefly to tune up the rig for maximum power without distortion, and during speech transmission, the voice-pattern peaks can be examined to be sure they are not exceeding this level. In this manner, peace of mind for the doubting Thomas can at last be obtained. ■

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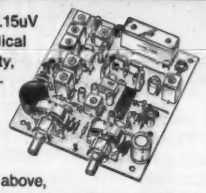

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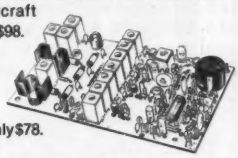

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	28–30	220–222*
	50–54	220–224
	144–146	50–52
	50–54	144–148
	144–146	28–30
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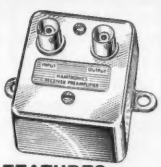

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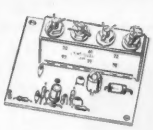

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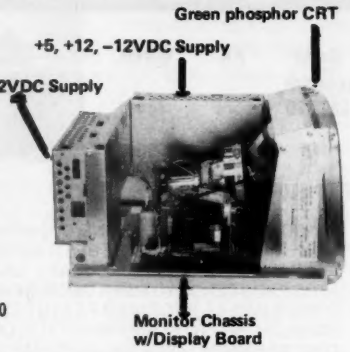

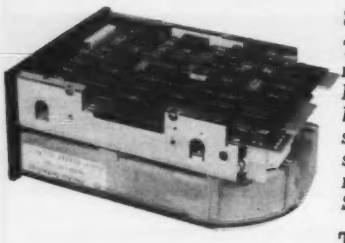

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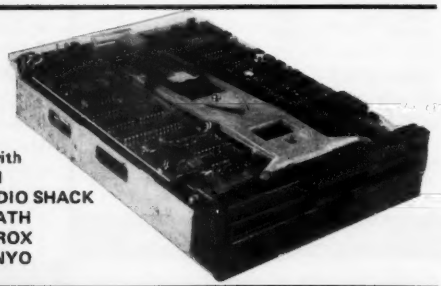

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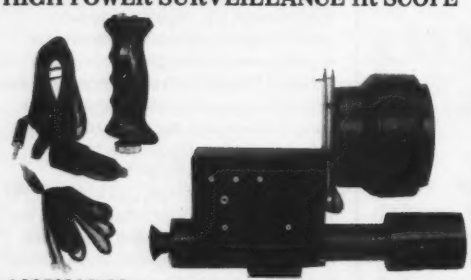

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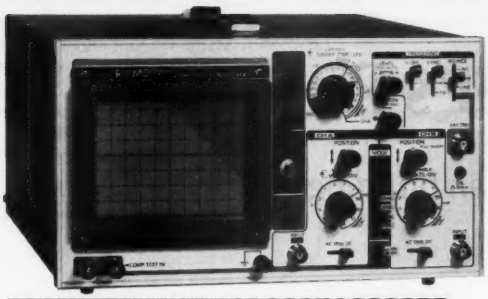

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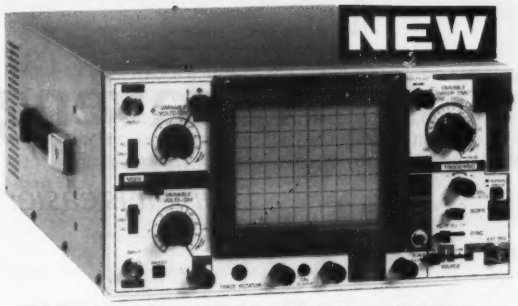

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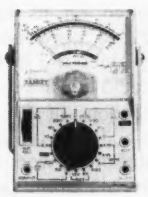

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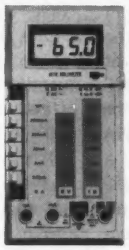
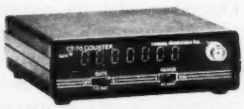


RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included



CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

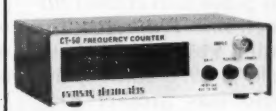
CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95



CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

VISA MasterCard

PHONE ORDERS CALL
716-586-3950
TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days; if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $15.00 add $1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units

RAMSEY

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14626

Steve Emmons KA0DMT
1408 W. Oak Street
Fort Collins CO 80521

A Scavenger's Radio

Using it is easier than building it.

This little receiver is actually a combination of two other previously-published (and therefore copyrighted) projects. The rf oscillator (Fig. 1) was built from scratch, following the schematic given in one of Radio Shack's "101-in-ONE Electronic Projects" kits. The detector/amp (Fig. 2) was originally described as a "High-Performance Transistor Radio," a souped-up "crystal set" from *Elementary Electronics'* supplementary publication entitled *101 Electronic Projects* ("for under $15—all easy to build"), 1978 edition; the radio was project #12, page 21.

The model I'm using now is a prototype and I'm sure it can use considerable improvement. I discovered quite by accident that holding the oscillator (at that time powered by its own battery) near the JFET radio (which already had its shortwave L_2/L_3 coil) would increase the gain and sensitivity an amazing amount. I suspect it's a regenerative effect, like the old "tickler coil" sets.

I found by experiment that the JFET radio's band coverage could be extended above and below the standard broadcast AM band (550 kHz to 1600 kHz) by using interchangeable coils of different sizes. This was before I added the oscillator. The selectivity is fairly good, and a double-tuned tank using a ganged padder capacitor might improve the selectivity. I described the above combination using the old TV coils because it works so well. Note: the oscillator needs some improvement to remove a tendency to break into audio oscillation at a couple of places on the position of L_1's tuning slug. Otherwise it's an amazing, easily constructed project that many others may find fun to try.

L_1 and L_2/L_3 are recycled coils from a broken TV set. They are slug-tuned with ferrite cores, approximately ¼ inch in diameter on plastic forms. No markings are visible on L_1, but it's wound with very fine enameled copper wire with a winding length of about ⅞ inch and is center-tapped. The two coils on L_2/L_3 have fewer turns and slightly thicker enameled copper wire with the winding interlaced; they were originally soldered together at a pin on the coil's base, making a center-tap, but to isolate the windings I resoldered one lead to an unused pin. $L_2/3$ has the code number TLS-51003.2 063V printed on its base. The distance between L_1 and L_2/L_3 is about 2 inches, but this could be varied.

Both sections of the circuit were built into a plastic box—metal might work better. External input jacks were provided for connecting the antenna and ground. I found out that the receiver actually works better without the ground, however. The circuit is powered by an ordinary 9-volt transistor battery, and the oscillator was left in the sardine can when it was put in the plastic box. Most of the parts were recycled from old TVs and radios. ■

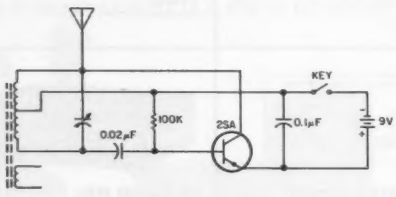


Fig. 1. The original rf oscillator circuit.

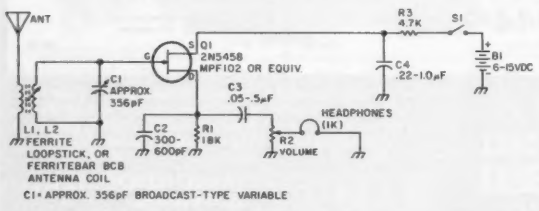


Fig. 2. The detector/amp, here disguised as a transistor radio.

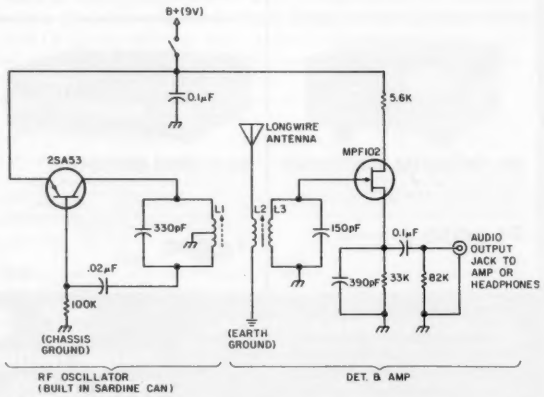


Fig. 3. A simple shortwave receiver. For more fun, use interchangeable plug-in coils.

CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you a one-year subscription (or extension), to be sent upon publication. Submit your idea to: Circuits, Editorial Offices, 73 Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*

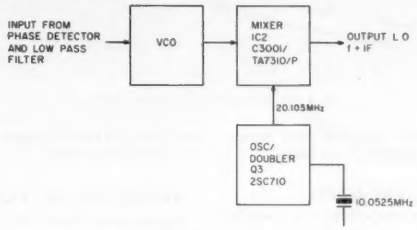


Fig. 1. Block diagram.

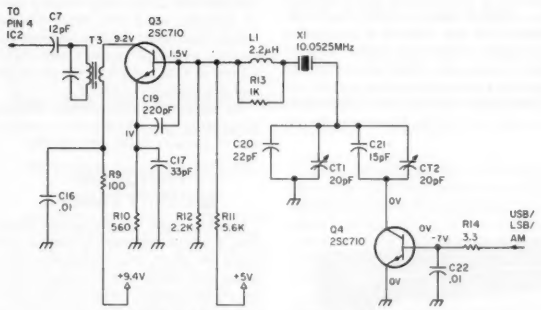


Fig. 2. Unmodified oscillator/doubler.

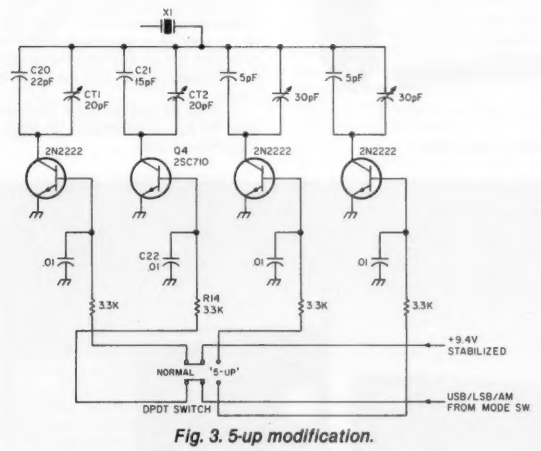
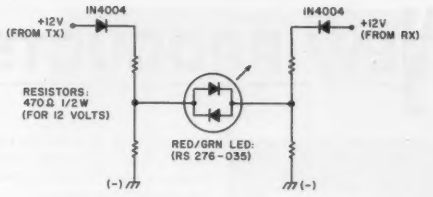
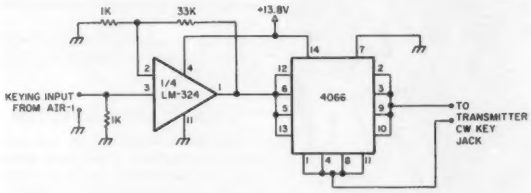


Fig. 3. 5-up modification.

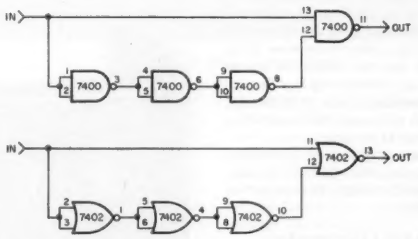
5-UP MODIFICATION FOR CONVERTED CBs: Add 5 kHz to the standard 10-kHz steps of a CB-to-10-meter conversion. Parts on the schematic are numbered according to the Tedelex 6000 or 7000, but other sets such as the Midland 19891 and similar GE rigs have also been successfully modified. Adjust the two new trimmers so that the rig now receives and transmits 5 kHz higher on all three modes. The three new transistors can be any silicon NPN types.—Shawn Barris ZR1EV, Cape Town, South Africa.



TWO-WAY LED: Here's a little bridge circuit that allows a front-panel LED to glow red or green from a switched positive voltage. Normally you would have to reverse the polarity across the LED, but this circuit does it for you. If your switched voltages are negative with respect to ground, simply reverse the diodes—Ron Johnson WA5RON, Austin TX.

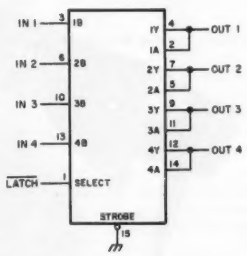


COMPUTER-TO-RIG INTERFACE: I needed a circuit to allow my VIC-20/AIR-1 to key an FT-707, which requires a set of closed contacts such as a straight key. The keying output of the AIR-1 is 0–0.6 V dc, which drives one quarter of an LM-324 op amp. The 13-V output of the LM-324 activates a CMOS switch, keying the rig. The four CMOS switch contacts are wired in parallel to reduce the "on" resistance.—Dave Ball WA4PQD, Barrington NH.



TWO-WAY EDGE DETECTION: When you need an edge-detector for a positive- or a negative-going change and don't want to use a one-shot, try this circuit. Using NAND gates will yield a single LOW pulse when the input goes from LOW to HIGH. Using NOR gates, a single HIGH pulse is generated when the input switches from HIGH to LOW. Any odd number of gates can be used in the delay leg feeding the final gate. The more delay gates used, the longer the output pulse.—Paul Selwa N9CZK, Brownsburg IN.

4-BIT TRANSPARENT LATCH: A fast, reliable, 4-bit transparent latch can be made from the 74157 series of data selectors. The latch is formed by connecting the outputs to their respective "A" inputs and applying data to the "B" inputs. While the select input is high (logic 1), the "B" input data appears on the outputs and on the "A" inputs. When the select input is switched low (logic 0), the output data is held via the "A" inputs until the select line again goes high. If the connections to the "A" and "B" inputs are reversed, this scheme will not work due to the switching delays within the IC.—Paul Selwa N9CZK, Brownsburg IN.



NEW PRODUCTS

Communications Specialists' TR-720 accessories.

TR-720 ACCESSORY CATALOG

Communications Specialists has announced the availability of a complete catalog of all accessories for use with the TR-720 hand-held air band transceiver. Since the TR-720 was first introduced almost two years ago, Communications Specialists has developed a total of 23 different accessories to improve the convenience and utilization of the radio.

For a free catalog, write to *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665; (800)-854-0547 or (714)-998-3021.*

ISO-TIP ELECTRONIC TECHNICIAN DRILL

Wahl Clipper Corporation has introduced a completely redesigned version of its popular ISO-TIP high-speed electronic technician drill. The 13,000-rpm drill features an improved 3-jaw chuck.

The operator can adjust the 3-jaw chuck to virtually any size aperture to accommodate any drill or burr with a shank diameter of up to .125 (1/8").

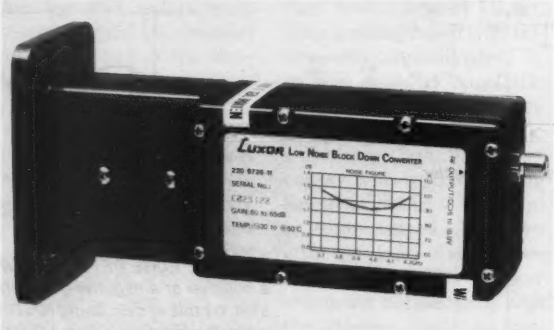
Weighing less than 5 oz., the drill's compact 6" length allows it to be used in confined areas and within cabinetry. The drill is ideal for prototype development, circuitboard revision and redesign, solder removal, lead hold cleaning, and a variety of other jobs. Burrs, abrasive wheels, or discs can be added to expand the drill's versatility to carve, shape, form, or rout on wood, plastic, leather, and a variety of materials.

For further information, contact *Wahl Clipper Corporation, Sterling IL 61081; (815)-625-6525.*

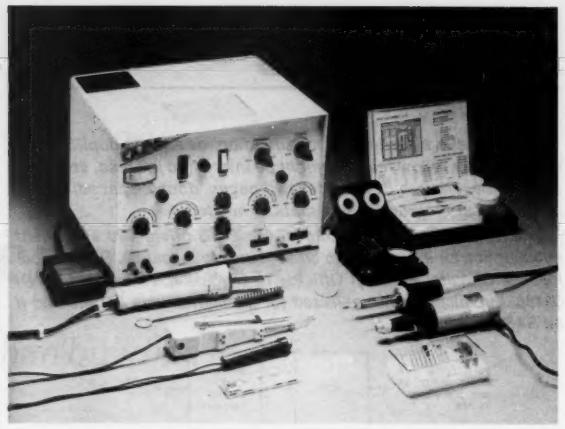
LUXOR DOWNCONVERTER

Luxor North America Corp. has introduced the 9726 Low Noise Block Downconverter (LNB) for use with Luxor Block Satellite Receiver Systems. It combines a low-noise amplifier (LNA) and block downconverter in one compact unit. Image rejection at 60 dB minimum and high-frequency stability in block conversion produce low-noise, sparkle-free video. Local-oscillator stability with a very low frequency variance of less than ±1.5 MHz means high resistance to temperature change.

For more information, contact *Luxor North America Corp., 600 108th Avenue NE, Suite 539, Bellevue WA 98004.*



Luxor's 9726 Low Noise Block Downconverter.



The A.P.E. PRS-475PG PCB repair system.

PRS-475PG

The A.P.E. PRS-475PG is a complete PCB repair system which features a microprocessor-controlled plating center that is capable of depositing 50 microns of gold for mil-spec edge-connector repair. The PRS-475PG also includes a desoldering handpiece, solder iron, thermal tweezer with 3 blade sets, reflow solder tool with practice kit, miniature drilling system, and circuit repair kit. For more information, contact *Automated Production Equipment Corp., 142 Peconic Avenue, Medford NY 11763; (516)-654-1197.*

8-POLE CRYSTAL FILTERS

International Radio, Inc., has announced a 2.1-kHz SSB matched crystal filter set for the TS-940S which consists of one 8.83-MHz 2.1-kHz drop-in 8-pole crystal filter and one 2.1-kHz 455-kHz 8-pole crystal filter (wired in). The matched set provides an overall system selectivity of 2.0 kHz at 6 dB and 2.5 kHz at 60 dB, as well as a shape factor of 1.25.

For more information, contact *International Radio, Inc., 364 Kilpatrick Avenue, Port St. Lucie FL 33452; (305)-335-5545.*

PHOTO TRAP SECURITY CAMERA

Mountain West has announced Photo Trap, a unique new security camera that snaps one bright, clear picture when triggered. Any device with a normally open dry contact (motion detector, door contact, holdup switch) can be used to trigger the camera.

Applications include all areas of security: burglary, vandalism, shoplifting, holdup, employee theft, etc. Photo Trap can be used as a stand-alone device or connected into an existing security system. Mounting is easy with the included bracket.

For more information, write *Mountain West, PO Box 10780, Phoenix AZ 85064-0780; (800)-528-6169.*

The redesigned ISO-TIP high-speed technician's drill from Wahl Clipper Corporation.

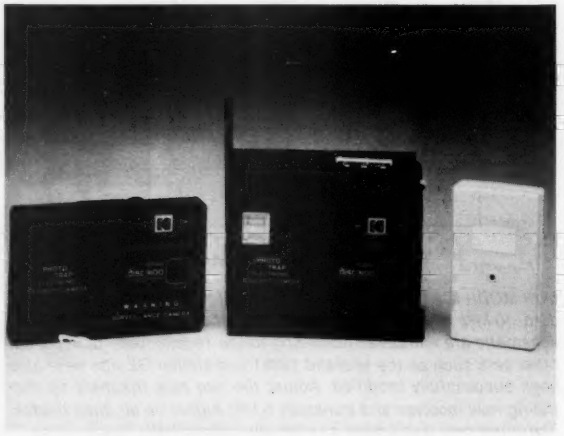
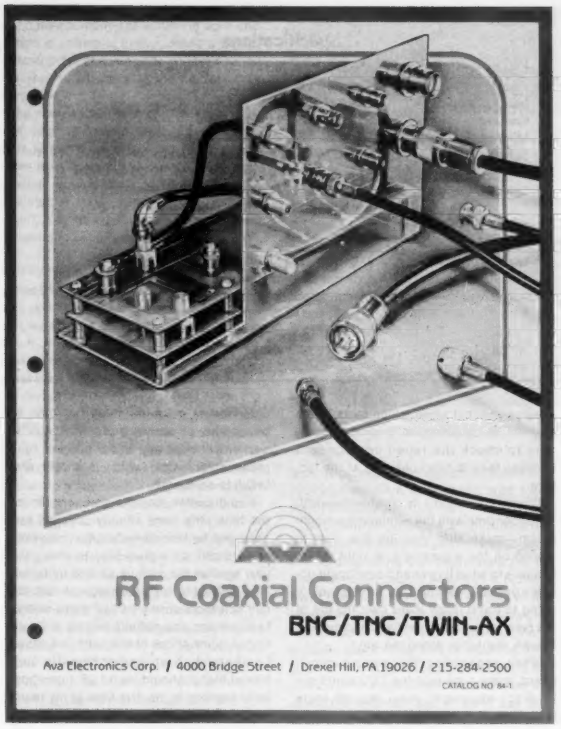
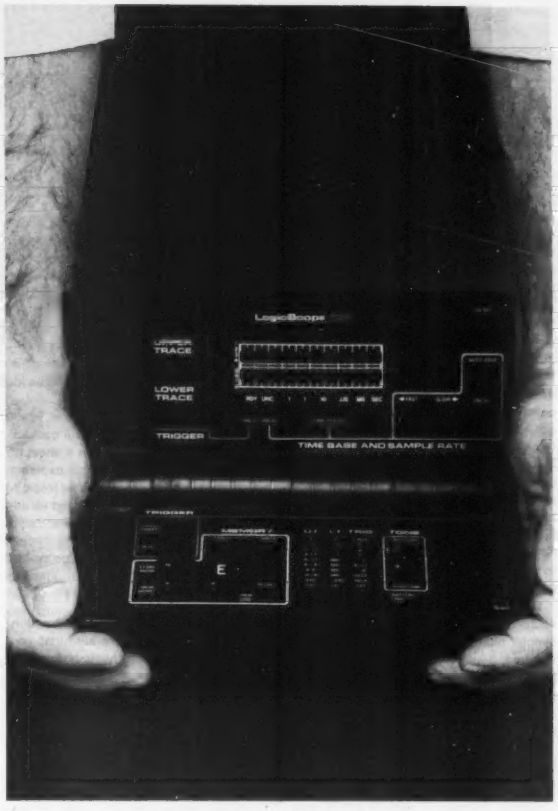


Photo Trap, a new security camera by Mountain West.


AVA
RF Coaxial Connectors
BNC/TNC/TWIN-AX
Ava Electronics Corp. / 4000 Bridge Street / Drexel Hill, PA 19026 / 215-284-2500
CATALOG NO. 84-1

The RF Coaxial Connectors catalog from Ava Electronics.



The LogicScope 136 from Jensen Tools.

RF COAXIAL CONNECTOR CATALOG

Ava Electronics has announced the new 84-1 catalog which concentrates on BNC, TNC (the newest addition to the line), and Twinax connectors, adapters, and cable assemblies. The catalog includes information on features, materials, and electrical characteristics of the products. UG-type connectors are cross-referenced where applicable. Standard cable assemblies are provided in 3-, 6-, and 12-foot lengths.

The catalog is available to all connector users. For more information, contact *William E. Cooper, Jr., Sales Office Manager, Ava Electronics Corp., 4000 Bridge Street, Dept. S, Drexel Hill PA 19026; (215)-284-2500.*

HAMTRONICS® CVR-900 SCANNER CONVERTER

Hamtronics, Inc., has announced a new converter for scanner radios to cover the 900-MHz land-mobile band. The CVR-900 is an adaptation of the CVR-806 (which covers the 806–896-MHz band). The CVR-900 allows coverage of new services now being assigned or proposed for the 880–960-MHz range, including additional land-mobile services such as police and fire departments, government and non-government fixed stations, industrial, scientific, and medical services, and the proposed 902–928-MHz amateur band. Also included are proposed new cellular telephone and paging services and existing and new broadcast studio-transmitter links.

The unit is equipped with Motorola-type connectors, so it can be simply installed in the coax line from the antenna to the scanner. Dc power for the converter is supplied by many of the scanners, and an ac adapter is available for other installations.

For a complete catalog, including information on scanner antennas, preamps, interference filters, and converters, please send $1.00 to *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716)-392-9430.* (For overseas mailing, please send $2.00 or 4 IRCs.)

ICOM IC-A2 AIR BAND HT

ICOM has announced the IC-A2 five-Watt PEP output aircraft hand-held transceiver. The ICOM IC-A2 includes all 720 COM and 200 NAV channels *plus* 720 additional COM channels and 200 NAV channels, ten owner-programmable memory channels, internal lithium-cell memory backup, LCD readout, air watch for scanning two key frequencies (with priority lock-on to your primary operating frequency), programmable scanning, frequency lock, a noise blanker, and slide-off battery packs for in-flight charging.

The ICOM IC-A2 comes with an IC-CM7 rechargeable NiCd battery pack, charger, LC-14 soft leather case, and earphone. A wide selection of options and accessories is available, including the ICOM HS-10 headset and HS-10SA VOX unit or HS-10SB push-to-talk switchbox.

For more information, contact *ICOM America, Inc., 2380 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

10-MHZ PORTABLE LOGICSCOPE

The LogicScope™ 136 from Jensen Tools, Inc., combines many of the features and capabilities of sophisticated logic analyzers and oscilloscopes. It is lightweight (1.25 lbs.), compact (8.25" × 4.5" × 1.75"), and fast (10 MHz). The instrument was designed for servicing digital electronic circuits and equipment and is especially well-suited for field work.

LogicScope replaces the conventional CRT with an array of 400 LEDs which permits the simultaneous display of two waveforms. It can be operated in real-time or memory mode. Memory mode permits acquisition and storage of up to twenty-four 128-bit waveforms. Waveforms can be recalled and logically compared (AND, OR, exclusive OR) to other stored or input waveforms. An RS-232 port provides for a modem link capability for signal transfers as well as for future expansion features.

The LogicScope features 10 sources for triggering, including free-run, Ch. A, Ch. B, and a trigger channel. A special trigger mode causes the LogicScope to trigger when a difference occurs between the lower and upper trace. Other features include a 50–100-ns glitch catcher, a BNC adapter for simultaneous use of three standard BNC-style test probes, an ac charger/transformer, a neck strap, and a detailed operations manual.

For more information or a free catalog, write or call *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.*

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need schematics or manuals for an Ameco Model PV preamp, Model CN converter, Model CB-6 converter, Model PS-1 power supply, and a Lafayette HA-225 receiver.

Richard McCubbin WD8RQH
Box 65
Mulliken MI 48861-0065

I am stationed in Japan and always miss sale items. I desperately need an external vfo and speaker for a Kenwood TS-520S. I will pay shipping.

AQ2 David Parks N4KHB/KA2DP
VA56 USS Midway
FPO San Francisco CA 96601

I need a service manual and schematics for a Singer/Gertsch FM-9 service monitor with an FC-3 frequency converter.

Geoff Fors WB6NVH
PO Box 2946
Carmel CA 93921

REVIEW

THE HEATHKIT SW-7800

I've been a ham now for almost 25 years. There's a lot of enjoyment gotten from talking to new and old friends on the ham bands. However, as with any other hobby, a person craves to branch out and expand his or her horizons. In my case, I thought it was time to try shortwave listening again as I had when I first started out. Since all my old shortwave gear is long gone, I needed something new to get back into general-coverage receiving while at the same time not spending a small fortune. Heath's great new SW-7800 general-coverage receiver kit seemed the way to go. I will attempt to explain my trials and triumphs in building this little gem.

Since all my gear is Heathkit I naturally considered them first in purchasing a new rig. They had just introduced their SW-7800 general-coverage receiver and, believe it or not, at a 10% discount. Since the kit price of $349.95 was fairly reasonable to begin with, an extra $35 discount was the clincher.

I realize that more money will buy more sophistication, but my criteria were rather simple: digital readout and digitally-synthesized, 1-kHz resolution or better at a reasonable price with a self-contained power supply, broadband tuning, and CW/AM/SSB capability. FM was desirable but not necessary.

I sent for the instruction manual first to be able to check out construction and schematics. Within 10 days the manual was on my doorstep and 2 days later the order was in the mail.

I deducted the price of the manual when I sent in my order as is customary with Heathkit, but when the kit arrived I found another manual inside the box! However, the enclosed manual had a 12-page correction booklet with it. The changes range from text errors on the circuit boards to replacing whole pages in the instruction manual. A small envelope of parts is packaged loose to be used for replacing incorrect or modified parts. I would imagine that in the future these changes will be incorporated into any revisions.

The first thing that you notice when opening the carton is the careful packaging of the components. There's a sheet of paper just inside the carton that explains how the box is packed and divided into different sections. You are instructed to unpack only the section that is called for in the manual. Each group includes a circuit board, parts, and hardware to complete that section of the manual.

Construction

As is usual with Heathkit, construction is very detailed. Just make sure that you take care of the errata sheets before you begin construction! In addition to the bags of loose parts, there are "taped components." These are the resistors, capacitors, and inductors that are fastened to a tape strip to simplify construction. The components are on the tape strip in the order in which they are used, and Heathkit assures you that when taking parts inventory before construction, it is not necessary to check the taped components because they've been checked at the factory.

Chassis assembly is straightforward. Take your time with the vernier drive mechanism—make sure that the dial cord is wound on the assembly just right. Don't hesitate to wind it over and over again until it's perfect. After all, that tuning knob is going to travel many miles over the life of the receiver and you don't want to cuss at it every revolution along the way!

When assembling the readout circuit board, make sure that the LED digits are in exact alignment. Even though there isn't much error possible when the numerals are inserted into the circuit board, there is enough to make the digits slightly crooked and the job look sloppy. You'll certainly notice it the first time you turn on the rig.

When assembling the controller circuit board, the only precaution to take is the soldering of the vco/vfo/inverter power-supply shields. After the shields are soldered to the board to form a box around the circuits, you are directed to solder the corners of the shields to prevent rf leakage. Since the shields form three sections, the two inner partitions are a little tough to solder. Make sure you have a 35–40-Watt tip on your soldering iron to do the job. The metal shields act as a good heat sink and quickly carry away the heat before a good solder bead has a chance to form.

The receiver circuit board is the largest board in the unit and therefore takes the most time. The components on the tape strip really save time here. Even so, allow 8–10 hours to do the job.

The synthesizer circuit board has the components mounted close together, so be careful of solder bridges. A solder-sucker will clear any solder bridges, but I prefer solder wick (which is simply wire braid) to do the job.

I said earlier that the components on the tape strip were already checked and need not be inventoried again. However, out of habit it's a good idea to check the part against the manual as it is installed. This worked to my advantage on this circuit board because a 0.01-μF glass-ceramic capacitor was substituted for a 0.1-μF unit. A quick check of the parts list, taped component chart, and schematic confirmed that it should be 0.1 μF. I can honestly say this is the first time in my many years of Heathkit building that I've encountered this. A quick check of my parts box produced a suitable 0.1-μF capacitor and I was off and running again. In the meantime, I fired off a warranty claim and 2 weeks later I received the correct value capacitor in the mail.

The matching transformer on the receiver board has to be wound by hand using fine-gauge solid enameled wire and a ferrite core, all supplied, of course. Keep pressing the wires against the core as you wind the turns and you'll have no problem. Be sure to use an object that won't scratch the enamel off of the wires when pressing the wires against the cord.

Installing the receiver board is a little tricky. The only real interference is from the ac-input terminal block near the front of the receiver. Keep the line cord, 13-V-dc input cable, line capacitors, and resistors tight against the terminal block and close to the chassis. That way the large receiver board will slip easily into place.

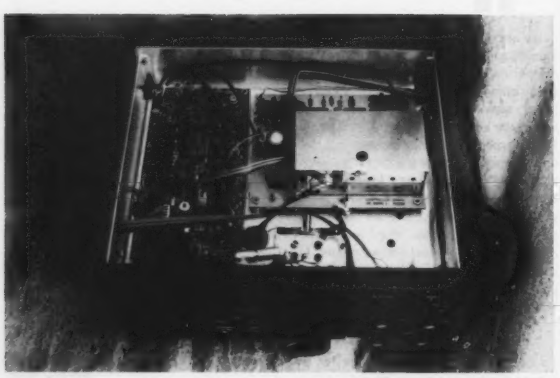
Alignment and Testing

The test and alignment procedure for

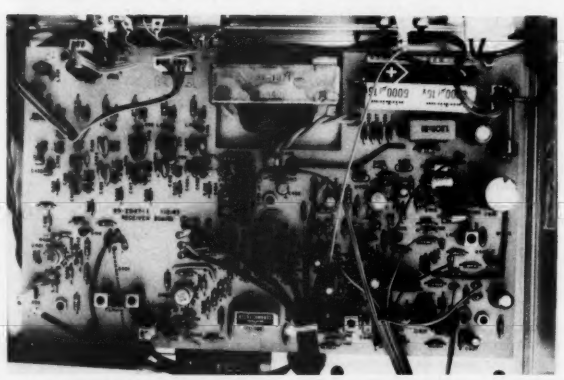
Specifications

Frequency Coverage:	150 kHz to 30 MHz in 30 1-MHz ranges
Frequency Readout:	Digital, 5 LED digits
Readout Accuracy:	Nearest 1 kHz
Frequency Control:	Synthesized, PLL and LC vfo
Modes:	CW/USB, LSB, AM (wide and narrow)
Sensitivity:	SSB/CW—less than 0.35 microvolts for 10 dB (S + N)/N AM—less than 2.5 microvolts for 10 dB (S + N)/N
Selectivity:	SSB/CW and AM narrow—2.5 kHz minimum at 6 dB AM wide—5.5 kHz minimum at 6 dB
Shape Factor:	1.5 at 6.50 dB
Image Rejection:	55 dB minimum
Dimensions:	11½" W × 10½" D × 4⅜" H
Muting:	External jack for transmitter
Recording:	Miniature phone jack on front panel
Antenna Connections:	SO-239 and Hi-Z
Power:	120 V ac/12 V dc, 11 W
Weight:	About 4½ pounds

Heath's SW-7800 receiver.



Inside the SW-7800. The receiver PC board is mounted below the sub-chassis.



The SW-7800 receiver board. At top right is the dc power supply; the vernier drive can be seen just below FL402.

each board is only a few paragraphs long and consists mainly of adjusting coils and checking voltages. I recommend a digital voltmeter for checking the voltages since it's easy to measure to the nearest one-tenth volt.

As soon as you turn on the receiver for that first alignment check, you should hear background hiss from the speaker. From then on you're home free. After zero-beating against WWV at 10 MHz and adjusting the SSB section of the receiver board, it's just a matter of sitting back and listening to your favorite station.

Conclusion

Heath provides general and detailed circuit descriptions, semiconductor charts, and suggested installation. After several hours of operation, the frequency calibration drifted somewhat and a simple touch up of the frequency trimpot was in order.

I found only two real faults with the rig—both related to portable operation. The first concerns the power cord. If the rig is intended to be taken mobile or for some other reason run off 12 V dc, there is no way to disconnect the ac power cord. I think that a detachable cord would save much aggravation.

The second point concerns transporting the rig. A small handle on the rear panel would be ideal so that the radio can be carried with one hand without fear of dropping it. I might add my own very soon.

Despite these minor drawbacks, I think that this receiver will be very popular. Someone will probably come up with an FM addition for it, and perhaps a modification for 100-Hz readout capability.

Heath has come up with another winner.

To receive more information about Heathkit products, contact *Heath Co., Dept. 150-395, Benton Harbor MI 49022.*

Greg Weiler K3MGQ
Birdsboro PA

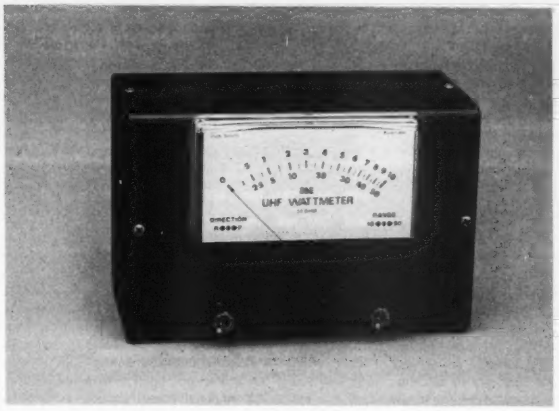
DICK SMITH ELECTRONICS UHF WATTMETER KIT

I'm going out on a limb and predict that one of the best things to happen to electronics in the US this year is the emergence of Dick Smith Electronics, Inc., the California-based arm of Dick Smith Electronics Pty. Ltd. of Australia. This unique company offers a full line of electronic parts, kits, and pre-wired assemblies using a marketing and advertising style that is sort of a cross between the old Poly Paks catalogs and Radio Shack.

According to their sales literature, the company has been in existence since 1968, when Dick Smith started his own two-way-radio service business. Today, it is a multi-million-dollar retail operation, but in typical fashion we here in the US have heard little or nothing about the company. However, that will change—very soon!

Among the many items that DSE carries in their product line are kits of all sorts—test equipment, experimenter's kits, audio amplifier kits, and even a line of introductory kits called "Fun Way into Electronics," which is apparently quite a hit "downunda" (that is, Australia). The development team at DSE apparently scours the amateur publications in VK-land looking for new ideas as well, which brings me to this particular review item—the model K-6312 UHF wattmeter kit which features 10- and 50-Watt ranges.

Shortly after the kit was received here, a call came in from Ike Bain, the President of DSE, informing me that I had been shipped the wrong meter movement for this kit. He thought I had been sent a 100-milliampere movement, when in reality it was a 1-milliampere movement. Regardless, a promise was made to forward a 100-microampere movement, and I set about building the kit.



The Dick Smith Electronics model K-6312 UHF wattmeter.

Dick Smith provides a considerable amount of information with this kit. A long article discussing swr (standing-wave ratio) from *Electronics Australia*'s November, 1984, issue is reprinted as part of the assembly instructions, presumably to give the builder a better idea of what he/she is actually measuring. This is followed by a short article describing the theory and operation of the wattmeter kit, and then the assembly instructions. A parts list and schematic round out the printed materials. (A supplemental folder describes the basics of kit building for the inexperienced.)

This wattmeter is very similar to the type I wrote about in the September, 1984, issue of *73* ("Elementary, My Dear: Watts 'n' Swr"). It uses a stripline transmission line (nominally 50 Ohms) with a pair of coupling lines running parallel to it on either side of the PC board. The one variation from the earlier *73* circuit is another piece of PC board laid across the top of the stripline to act as a shield (similar to a piece of coaxial transmission line). Hewlett-Packard 2800 hot-carrier diodes detect the forward and reflected voltages, which are fed to several trimpots to set the detecting ranges. A 100-microampere meter is used to display the forward and reflected values.

Kit assembly is not complicated and even the most cautious worker can put this together in three hours. All parts are sealed in plastic and there are generous amounts of extra hardware and solder pins for making connections to the PC board. However, the original meter that was shipped had its face held on with sticky tape and the mounting screws were nowhere to be found! This complicated matters when I tried to fit the custom DSE wattmeter scale to the original 1 milliampere meter, and I had to resort to using a thin coat of rubber cement to hold it in place. The subsequent arrival of the correct meter solved the problem, as it had the correct screws with it.

Another tricky aspect of this project is the assembly in and around the enclosure, which is basically a one-piece box with the sides open. These sides are closed with two panels when the project is complete. The final result looks sharp but it makes for a few wiring headaches during assembly. Once the stripline assembly is complete, it is then fastened to a tinned shield plate and attached to two BNC-type connectors on the rear panel. The top shield PC board is then fastened with two nylon screws. At this point, you are advised to solder the edges of the stripline board to the tinned shield plate *through* the meter hole in the box. This is quite tricky if you want to get a good soldered edge all the way around the board.

I would suggest using a chisel tip for your iron to do this job since there isn't a lot of room to maneuver around. Also, you have to install the front-panel switches and then solder their associated PC boards to their terminals to make sure they line up correctly. This is detailed in the instructions. Finally, securing the meter itself to the front panel requires dexterity with a socket from a drive set, since the clearance will not allow for a drive handle. Using pliers to tighten these small nuts is cheating and won't provide the secure fit necessary!

To summarize construction: The assembly manual is straightforward but the technique is unusual. It can be accomplished by the novice builder, although having small agile fingers helps in a few cases.

Now to the nitty-gritty. How well does it work? A test setup was made using a short piece of Belden 8214 from a Microwave Modules 432-28S transverter. This in turn fed the DSE wattmeter, and then, using adapters, a Bird Model 43 coupler was attached to the output of the DSE wattmeter and terminated in a Bird Termaline 50-Watt coaxial resistor. The MMT 432-28S normally puts out 10 Watts when driven by a Kenwood TS-430S.

Both forward and reflected ranges were calibrated against the Bird. To ensure the highest accuracy, calibrations were made at mid scale on both meters (i.e., 5 Watts). Additionally, measurements were made with the Bird before the DSE wattmeter to verify its claimed 50-Ohm impedance rating. The displayed-power comparisons were as follows:

Bird Model 43 (Watts)	DSE UHF Wattmeter (Watts)
1	.75
2	1.75
3	3
4	4
5	5
6	6
7	7
8	8.25
9	9.5
10	Off scale

Not bad! The next step was to check the 50-Watt power range. A 100-Watt slug was put in the Model 43 and the range switch on the DSE wattmeter was set to 50. Calibration was made at mid scale—in this case, 30 Watts on the DSE, which is slightly less than mid scale on the Bird 43. Measurements were made at five different power ranges using the same coaxial resistor and throttling back a Mirage D1010 amplifier's output to obtain the desired power levels. The displayed-power comparisons were then as follows:

Bird Model 43 (Watts)	DSE UHF Wattmeter (Watts)
10	12.5
20	22
30	30
40	40
50	50

Again, very respectable. The inaccuracies at the high and low ends are not unexpected. Bird claims only 10% accuracy of full scale, especially on lower-power readings. The next question was "if this was indeed a 50-Ohm instrument, what would stop me from using it on 220 MHz and even 144 MHz?" (except for recalibrating the range pots). The answer is that it really isn't a 50-Ohm instrument, but that doesn't surprise me. Many of the boards I tested for the earlier *73* stripline wattmeter showed inconsistencies from batch to batch in this regard.

In summary, the Dick Smith Electronics UHF wattmeter kit is a well-designed, good-looking piece of test equipment. It can fill a need for the more serious UHF enthusiast and is relatively simple to construct using mostly conventional techniques. Ample documentation is supplied with the kit to ensure success. In addition, DSE supplies a "Sorry, Dick—It won't work!" coupon to allow for repairs by a DSE facility. Additional coupons allow for a calibration procedure by DSE using a Bird Model 43 for a nominal sum. The kit sells for $44.95 plus shipping and handling.

One additional note: Try to obtain the latest DSE flyer. This has to be the funniest direct-mail piece I've read in a long time. I can hardly wait for the catalog to show up!

For more information, contact *Dick Smith Electronics, Inc., PO Box 2249, Redwood City CA 94063.*

Peter Putman KT2B
Morris Plains NJ

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

THE SEIKO DATA-2000

As amateur-radio operators, we have a unique habit of exploiting the capabilities of a variety of electronic equipment. From modifying a surplus radio to converting a CB transceiver for ten-meter use, we are constantly adapting and applying technology to meet our needs. However, not all equipment requires modification to be useful. A perfect example of this is the widespread use of microcomputers in the ham shack to handle the laborious task of log keeping, QSLing, and other paperwork. A new piece of equipment which I have

found to be useful in many amateur-radio applications is the Seiko Data-2000 wristwatch system.

The Seiko Data-2000 is a computerized wristwatch which includes a wrist unit and a keyboard. The wrist unit looks and wears like a regular watch. It displays the time (hours-minutes-seconds), date (month-day), and has an alarm and a stopwatch. The watch also features an additional function which makes it one of the most powerful watches available: a nonvolatile 2000-character memory in which any text can be stored after being input via the keyboard unit.

The watch's memory is divided into two areas (labeled A and B) of 1000 characters apiece. Each memory can be recalled and viewed on the watch's 10-character-by-4-line LCD display. The memory can be scrolled up or down, displaying 40 of the 1000 characters at any one time.

Data are input to the watch from the keyboard via a special transmission circuit which utilizes an inductive method similar to that used in wall transformers. The watch and the keyboard unit each contain a matching coil. When data are transmitted from the keyboard to the watch, a magnetic field generated by the keyboard's coil cuts across the coil in the watch, generating a current in the watch's coil. This current switches on and off to transmit the digital information. This method of transferring the data allows the watch to remain sealed and eliminates the need for cables and other wires.

The wristwatch measures 3.5 cm wide by 4 cm long by 1.2 cm thick with aluminum and stainless-steel construction. The band is adjustable and is also stainless steel. The watch is entirely black, with the exception of the silver back, the gold lettering, and the buttons.

Seiko's Data-2000 wristwatch.

Directly beneath the LED display are four buttons. The first button, starting from the left, is used for clearing the stopwatch, setting the time and date, and scrolling up through memory. The next button in line is used for selecting the mode, whether it is time and date, memory A or B, the alarm, or the stopwatch. The transmit button is used for initiating the transfer of data from the keyboard. The last of the four buttons is used for starting and stopping the stopwatch, setting the time and date, and scrolling down through memory.

The keyboard features a 61-key QWERTY layout along with cursor-control keys and various special symbols. To communicate with the watch, the back of the watch must first be placed on a section of the keyboard labeled Transmission Circuit. Once the keyboard is turned on and the transmit button on the watch is pressed, the watch is ready to receive data. From the keyboard, memory A, memory B, or a calculator mode may be selected.

If one of the memories is chosen, any data typed on the keyboard will be transferred to the watch's memory. There are several special symbols, such as a telephone and an airplane, which can be used as a heading to conserve space. The calculator mode allows simple arithmetic (addition, subtraction, multiplication, and division) to be performed and displayed on the watch's display.

This powerful watch's many capabilities can be applied in a number of amateur-radio applications. Imagine going to a hamfest with a complete list in memory of all that you are looking for, from tubes and other parts to the back issues needed to complete your magazine collection. A portable logbook, a repeater directory for your next trip, and skeds complete with names, calls, dates, and frequencies are all useful information that could be stored in the watch for instant recall.

This watch represents the incredible advances in solid-state technology that have been made over the past several years and makes one wonder what the future holds. It is wonderful fun to use and I'm still coming up with new applications for it. While its list price of $195.00 may discourage some potential buyers, recall the calculator revolution in which the price of calculators dropped by several hundred dollars over the course of a few years. A similar drop in the price of the watch can also be expected as its technology becomes commonplace; even today, the watch can be found discounted well below list price.

Once you start using this watch, it is difficult to get along without it. And one thing is for certain—its applications are limited only by the imagination of the user.

For more information, contact *Hattori Seiko Co., Ltd., 6-21 Kyobashi 2-Chome, Chuo-ku, Tokyo 104, Japan.*

Jonathan Mayo KR3T
Media PA

RTTY LOOP

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For many years, whenever I was asked for a simple circuit for a RTTY AFSK generator, I referenced a one-transistor wonder that I wrote about in an article in *73* several years ago. I liked this particular circuit because, although it used the familiar 88-mH toroid coils once so ubiquitous in amateur RTTY, it was relatively straightforward to build and simple to adjust. The only thing I didn't like about it was that the waveform was not a true sine wave, so using it on SSB to generate HF RTTY was out. But the circuit was designed for VHF AFSK links, and there it did well. And these days finding those toroids, which used to be five-for-a-dollar and in every ad and on every table at hamfests, has become nearly impossible.

Well, sorry, old buddy, but I have a new favorite. As I mentioned last month, these two cuties caught my eye while I was strolling through my local Radio Shack in Towson. Not salesgirls, although they are not bad either, the two in mind are chips of particular interest to the RTTYer. Last time I talked about the XR-2211 phase-locked loop as a basic demodulator, so this month let's have a go at the XR-2206 function generator.

This little cutie, marketed under Radio Shack's stock number 276-2336 and sold for six bucks or less (on sale), is a stable source of frequencies in the range of fractions of a Hertz to one megahertz or more. All it takes is a few passive components, that is, resistors and capacitors, and you are ready to roll.

An AFSK generator which puts out high-quality sine waves at standard (or nonstandard, for that matter) amateur RTTY frequencies is shown in Fig. 1. A few words of explanation are in order. First of all, the +Vcc for this chip is 10 V dc, not five, as with common TTL chips. The RTTY keying voltage is fed to pin 9, referenced to ground, and should show a swing from less than one volt to more than two volts. We will look at how that is accomplished in a second. Next, the two audio frequencies are determined by the combination of the capacitor between pins 5 and 6, which should be a stable 0.01-uF capacitor (not a plain garden-variety disk—these often show far too much drift), and the resistors going to ground from pins 7 and 8.

The frequency generated by a high-level signal on pin 9 is determined by the resistor on pin 7, and the frequency generated by a low-level signal on pin 9 is determined by the resistor on pin 8. The relationship is determined with the formula $f = 1/(R \times C)$. So, with a 0.01-uF (0.00000001-F) capacitor and a 45000-Ohm resistor, a frequency of approximately 2200 Hz would be generated. That is why I show 50k-Ohm potentiometers for the two frequency-determining resistors. You could certainly use a fixed resistor and potentiometer combination (such as a 30k-Ohm resistor and a 25k-Ohm potentiometer in series) to allow finer adjustment over a more narrow range; it's up to you.

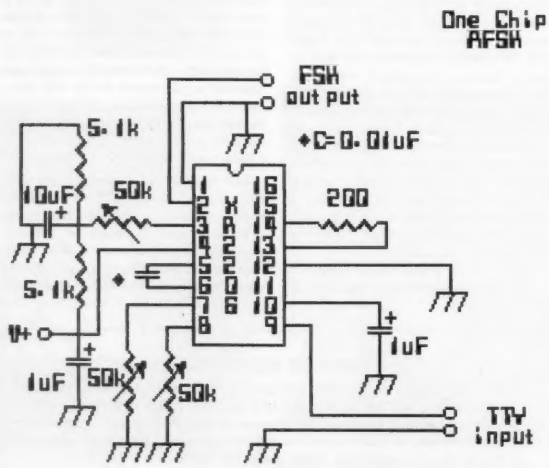

Fig. 1.

So far I have avoided calling either frequency mark or space, and with a good reason. It will depend how you are keying the circuit. If you have a setup where a positive voltage represents mark, and either ground or a negative voltage represents space, then the mark frequency will be determined by the resistor on pin 7, and the space frequency by pin 8. However, if you are keying this with an (pardon the expression) "RS-232" voltage level, then the mark will be a negative voltage, and the space a positive, and the situation is reversed! In that case, use the potentiometer on pin 8 to set the mark, and pin 7 to set the space.

I mentioned that this circuit is not bound to the "standard" RTTY frequencies, and I meant that. Although I am sure many of you will be setting up for mark = 2125 Hz and either 170-Hz shift (space = 2295 Hz) or 850-Hz shift (space = 2975 Hz), there is no reason in the world to feel that those frequencies are engraved in stone if you will be feeding the signal through an SSB transmitter to produce HF FSK. So, for example, you may choose to use a frequency closer to the midpoint of the audio passband, like 1600 Hz for mark and 1770 Hz for space; it all depends on you. (Hmm... sounds like a song cue!)

Let me see—what else can I tell you?

Oh, that the potentiometer connected to pin 3 controls output amplitude. My specs tell me that you will get about 60 mV of output for every kilohm of resistance, so with a maximum of 50k Ohms, you should be able to get about 3 volts peak to peak, more than enough to drive your transmitter, I would think. Of course, you will need some kind of standard to set this thing on frequency, which can range from a frequency counter—they're getting so cheap now that it is hard to imagine being without one—to a well-calibrated demodulator. Then again, if you are building a demodulator as well and have no standard, then we can get very Einsteinian and speak of relative frequency and motion, but better you should find a buddy with a standard you can anchor to.

Good luck—with this circuit, and the one shown last month, you should be able to get onto RTTY on a shoestring without too much trouble—assuming you have a terminal of sorts, of course. But that is a topic for another column!

I have a letter here from Jim Engelen WD0BIE, in Mankato MN, who is using a CoCo on RTTY and writes of being told that he is "upside down" when transmitting on HF. Well, Jim, there are at least two possible reasons for this happening. The first is related to the manner of keying, as discussed above. Various keying circuits interpret mark and space differently, and if you are generating a positive voltage for mark and feeding it to an RS-232 input which expects a negative, well you get the picture. The solution is to change the way you are generating the voltage, if possible, or read the next problem and its solution and try that.

The other reason for this happening is if you were transmitting on the "wrong" sideband. Let's see why this happens. Starting out with the desired HF signal, recall the old saw, printed here many moons ago: LSMFT—Low Space Means Fine Teletype. Now I know that to you younger folks these letters mean nothing, but trust me, they have been an effective mnemonic until recently. However, the standard on AFSK is to have, as I mentioned above, a low mark frequency and a high space. Now, if you transmit on lower sideband, the frequency transmitted is the difference of the center frequency minus the audio frequency. So, a higher audio tone for space will result in a lower rf space frequency. However, if you are transmitting on upper sideband, the audio tones are not inverted and you will be transmitting upside down from the normal HF convention. This becomes a problem with some HF rigs which automatically select the sideband based on the conventional sidebands used per band. So, on ten meters, where upper sideband is usually used, these transmitters will transmit RTTY upside down, if used in the "normal" way. The solution is to switch sidebands, if you can. If you can't, then you have to go back and swap mark and space somewhere else in the system, either in the way you are keying the transmitter, with an inverter, or in the software you are using, if it is capable of doing that. Let me know how things work out.

Regards to another CoCoNut, Bob Billson KC2WZ, of Westfield NJ. Bob is looking for a program to use his CoCo on TDD systems to communicate with the deaf. Such a program is available in the CoCo SIG on CompuServe. This brings up the side topic of what to do with your old machines when you computerize. I don't know how many of you are aware of the use of Murray machines by the deaf, but I'm sure that many of you have seen this or that public-service agency print a special telephone number detailed either as TTY, whose meaning is obvious, or TDD, which stands for TTY Device for the Deaf. If you have an older Model 15 or the like lying about, why not contact a local agency and see if it could not be put to good use serving the needs of the hearing-impaired in your community. Public service is not always on the air, you know.

I had hoped to print some photos of this year's Greater Baltimore Hamboree and Computerfest, sponsored by the Baltimore Amateur Radio Club, in this month's column. Unfortunately, those photos, along with a smashing one of my youngest, remain lost within the bowels of Eastman Kodak, somewhere between here and Rochester. Hopefully I will have them back in time for next month. I think you will enjoy them.

Several of you have forwarded comments to me complaining of poor response by a number of suppliers of RTTY programs and equipment. I have sent these letters on to the respective manufacturers, and some of them have been answered. About all I am willing to say at this point in time is that if you have written to me complaining of a problem and that problem has still not been solved, please drop me another note. The companies' concerned responses are praiseworthy; I only hope that they represent actions, not words alone.

The files are also filling up with information on many more RTTY programs for the various personal computers that I knew existed. I think you will enjoy the list being put together and perhaps find new avenues to explore. It's never too late to let me hear from you with your opinion on this piece of software or that piece of hardware. I am trying to keep a current list, which shall join the other reprints available from this column to be available from this address. *Not yet*, though! Wait until the first edition is published in this column. It just might answer all your questions.

As always, I remain reachable at CompuServe ID 75036,2501, via E-Mail or on the CoCo SIG. Feel free to drop me your comments there as well as in the mail at the above address. If you have a question that is too involved to send on E-Mail, but the answer could be sent that way, include your ID in your letter and I will try to send the answer electronically. I aim to please.

Stay tuned to the next few months as we look at as many ways to get on RTTY as we can, trying to avoid high-ticket items if at all possible. I enjoy your input, and from that input I know you enjoy my output, right here in "RTTY Loop."

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of August are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
AUGUST 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1935	1	1100	238	4	224	16	197	28
1937	2	1000	230	12	214	22	183	31
1939	3	0900	221	20	202	28	169	31
1941	4	0900	215	20	195	27	164	27
1943	5	0800	203	26	182	29	151	25
1945	6	0700	191	30	169	30	139	20
1947	7	0700	184	27	163	26	136	15
1949	8	0600	171	28	150	23	126	9
1951	9	0500	157	27	139	19	117	2
1953	10	0500	152	22	135	14	115	0
1955	11	0400	141	18	126	8		
1957	12	0300	130	13	117	1		
1959	13	0300	128	7				
1961	14	0200	119	1				
1962	14	1300					243	3
1964	15	1300					237	5
1966	16	1200					229	13
1968	17	1200					223	14
1970	18	1100			236	5	213	21
1972	19	1000	241	1	228	13	202	26
1974	20	0900	234	9	218	20	189	30
1976	21	0900	228	11	212	20	182	28
1978	22	0800	219	18	200	25	169	28
1980	23	0800	212	18	194	24	163	24
1982	24	0700	201	23	181	26	151	22
1984	25	0600	189	27	168	26	140	17
1986	26	0500	176	28	155	24	130	12
1988	27	0500	170	25	151	20	127	6
1990	28	0400	157	23	140	16	119	0
1992	29	0300	145	20	130	10		
1994	30	0300	142	15	127	5		
1996	31	0200	132	10				

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ATLAS 350XL OWNERS GROUP. Free newsletter. Send QSL with rig s/n and SASE. Know people who repair them? Information to share? Questions? Rod N5NM, Box 2169A, Santa Fe NM 87501. BNB291

1985 "BLOSSOMLAND BLAST," Sunday, October 6, 1985. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB296

FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

CX7 REPAIRS. Mark Mandelkern, 2315 Derby St., Berkeley CA 94705; (415)-549-9210. BNB320

DX ADVENTURE on Montserrat, only $250/week. Details: Chod Harris VP2ML, Box 4881-7, Santa Rosa CA 95402. BNB321

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

FREE: 100 QSLs with first order. Samples 50¢. Gazebo Press, Rt. 4 Box 4148, LaPlata MD 20646. BNB327

ELECTRON TUBES: receiving, transmitting, microwave...all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

WANTED: radios, tubes pre-1939 for my collection. Howard Stone, HCR-3, Box 418, Deer River MN 56636. BNB332

CODE-PRACTICE PROGRAMS diskette for IBM PC, PC/jr. $10.00 ppd. Andrew Modla/73/N3EGH, 5 Derby Place, Newtown PA 18940. BNB334

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 356, Wheaton IL 60189. BNB335

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COMMODORE Authorized Service Center, 24-hr. service. WA2AJQ, 303 S. Vermont Ave., Royal Oak MI 48067; (313)-399-3990. BNB337

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RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

RADIO OFFICER WANTED: FCC and USCG licenses and 6-month endorsement required for sea-going employment. Excellent money and fringes for technically qualified person. Send resume and copies of licenses to: Box NH 2493, 810 Seventh Ave., New York NY 10019. BNB348

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

ANTIQUE RADIOS, schematics, tubes, and literature. Send $1.00 to VRS(ST), 376 Cilley Rd., Manchester NH 03103, for a large catalog. BNB350

TOO MANY MICROPHONES on your operating desk? With the SISCO model 612 mike control you can now use one microphone with several rigs. Prices start at $15.95. Southern Instrumentation, PO Box 5097, Ormond Beach FL 32074; (904)-673-1059. BNB351

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REPLACE RUSTED ANTENNA BOLTS with stainless steel. Small quantities, free catalog. Elwick, Dept. 554, 230 Woods Lane, Somerdale NJ 08083. BNB353

3-500Z, $70.00 each plus shipping, 50-year collection of tubes. W5QJT, PO Box 13151, El Paso TX 79913; (915)-532-2509. BNB354

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WANTED: schematics for Motorola U43GGT tube-type VHF police transceiver. Emil Kubanek W8BVR, 6298 Old Allegan Road, Saugatuck MI 49453. BNB356

COMMODORE 64 CW INSTRUCTOR PROGRAM. Generates CW on TV speaker. Random code, keyboard input, or prerecorded "CW Tests." Character speed and spacing set independently. Designed for classes and increasing code speed. $15.00—diskette or cassette (specify). Dennis Oiver N7BCU, 22000 S. Tonya Ct., Beavercreek OR 97004. BNB357

9Q5GB: My logs show thousands of unclaimed QSL cards from contacts in 1978 from Africa. To claim yours, send QSL and $2.00 to: 9Q5GB, PO Box 193, Firestone CO 80520. BNB358

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

KALAWAO COUNTY HI
JUL 25-28

The Kauai Amateur Radio Club will operate station KH6F from Kalawao County, a leper settlement on the island of Molokai, on July 25-28, 1985. Operation will be on 80, 40, 20, 15, 10, and 2 meters using SSB, FM, and CW. To QSL, send an SASE (or SAE and IRC) to KH6F, PO Box 675, Koloa HI 96756.

OKLAHOMA CITY OK
JUL 26-28

The Central Oklahoma Radio Amateurs (CORA) will sponsor Ham Holiday 85 (HH 85) and the ARRL Oklahoma State Convention on July 26-28, 1985, at the Lincoln Plaza Inn, Oklahoma City OK. Pre-registration will be $8.00, $4.00 for each non-ham family member. Registration at the door will be $10.00. Activities will include commercial displays, flea market (on Saturday only), QCWA breakfast, MARS, SMIRK, Oklahoma Repeater Society, license exams, and various technical and nontechnical forums. For more information, write Ham Holiday 1985, PO Box 60093, Oklahoma City OK 73146.

GREENSBURG PA
JUL 28

The Foothills Amateur Radio Club, Inc., will sponsor the seventeenth annual Greensburg Hamfest on Sunday, July 28, 1985, at the Nevin Arena, Greensburg PA. Tickets will be $2.00 or 3/$5.00. Indoor ta-

bles will be $5.00 and tailgating will be $2.00. There will be refreshments. Talk-in on 147.78/.18. For further information, advance registration, or tables, write FARC, Inc., PO Box 236, Greensburg PA 15601, or contact WB3KJH.

DENVER CO
JUL 30–AUG 1

The Amateur Radio Motorcycle Club Rocky Mountain Roundup III will be held July 30 through August 1, 1985, somewhere west of Denver CO. The exact location will be named later. Riding radio operators check the ARMC Net on Thursday nights, 0300 UTC, 7237.5 kHz. Send a business-size SASE to Gary McDuffie AG0N, Rt. 1, Box 464, Bayard NE 69334, and ask for net information.

AUSTIN TX
AUG 2–4

The Austin Amateur Radio Club and the Austin Repeater Association, in conjunction with the Texas VHF-FM Society, will sponsor the third annual Austin Summerfest on August 2–4, 1985, at the Austin Marriott Hotel, Austin TX (intersection of I-35 and US 290, on the northeast side of Austin). Registration for all people 18 and older is $5.00 in advance, $7.00 at the door. Swapfest tables will be available on a first-come, first-served basis beginning at 6:00 am on Saturday. Swapfest fees are $1.00 per table, with a two-table limit per registrant. Features will include seminars, a QCWA-sponsored hospitality suite, dealer displays, license exams, and alternate activities. Talk-in on 146.34/.94 and 146.19/.79. For more information, contact Austin Summerfest, PO Box 13473, Austin TX 78711.

POMONA CA
AUG 3

The Tri-County Amateur Radio Association will sponsor a hamfest on Saturday, August 3, 1985, from 8:00 am to 2:00 pm, indoors at the Palomares Park Recreation Hall, 491 E. Arrow Highway, Pomona CA (N. side of Arrow Highway at Orange Grove, between Towne and Garey). Admission is $1.00. A limited number of 2-1/2 × 8 tables will be available for $5.00 per table. Setup is at 7:00 am. Tables must be reserved (call Joe Lyddon WB6UFX at (714)-980-4563). Refreshments and free parking will be available. License exams will be given. For more information or for advanced registration (make checks payable to TCARA), send an SASE to Joe Lyddon WB6UFX, 6879 Sard Street, Alta Loma CA 91701.

TALK SO THEY MAY WALK
AUG 3–4

The Kansas City MO Ararat Shrine Radio Club (WA0NQA) will host its second annual talk-in on August 3–4, 1985, for the benefit of the Crippled Children's Hospitals. We will look for you on the air from 10:00 am to 10:00 pm CST. We will be on the lower 10 kHz of 80, 20, 40, and 15 meters, as well as the 40-meter Novice band. We will offer a two-color certificate with your call and name. Send a large SASE and $1.00 to QSL Manager, Mr. J. V. Foust KA0GBK, 5240 N. Palmer, Kansas City MO 64119.

JACKSONVILLE FL
AUG 3–4

The twelfth annual Greater Jacksonville Hamfest will be held on August 3–4, 1985, from 8:00 am to 5:00 pm on Saturday, and from 9:00 am to 3:00 pm on Sunday, at the Jacksonville Civic Auditorium, on the waterfront in downtown Jacksonville. Admission is $4.00 and children under 16 will be admitted free. Swap tables are $9.00 for one day and $15.00 for both days. Forums, meetings, technical presentations, and an exhibitors' area and indoor swap area will be featured. The facilities are completely air conditioned. For more information, table reservations, or hotel information, send an SASE to the Jacksonville Hamfest Association, PO Box 23134, Jacksonville FL 32241.

GLENN MI
AUG 4

The Black River Amateur Radio Club will sponsor its annual VHF Picnic and Swap and Shop on Sunday, August 4, 1985, from 10:00 am to 3:00 pm, at the West Side Allegan County Park near Glenn MI (10 miles north of South Haven via I-196, Exit 30). Admission will be $2.00. There will be free table and trunk sales. There will be picnic tables, a playground, a Lake Michigan beach, and ample parking. There is no food vendor in the park. For more information, contact Ed Alderman KI8Z, 56500 48th Ave., Lawrence MI 49064; (616)-674-3567.

PITTSBURGH PA
AUG 4

The 48th annual South Hills Brasspounders and Modulators Hamfest will be held on August 4, 1985, from 9:00 am to 4:00 pm, at the South Campus of the Community College of Allegheny County, Pittsburgh PA. Tickets are $3.00 each or two for $5.00. Features include OSCAR, RTTY, and packet forums, plus a flea market. Talk-in on 146.13/.73 and 146.52 simplex. For more information, contact Bill Gardiner, 4756 Child Drive, Pittsburgh PA 15236.

LEVELLAND TX
AUG 4

The Northwest Texas Emergency Net and Levelland Amateur Radio Club will sponsor their annual picnic and tailgate swapfest on Sunday, August 4, 1985, at 7:30 am, at the City Park in Levelland TX. Admission is free. . .od and drink will be available. Talk-in on 146.88 (repeater). For further information, contact John Bell W5NGX, 208 Pat Street, Levelland TX 79336.

ANGOLA IN
AUG 4

The Steuben County Radio Amateurs will sponsor the 27th annual Crooked Lake Hamfest and FM Picnic on Sunday, August 4, 1985, at Crooked Lake, Angola IN. Admission is $2.50. There will be an exhibition hall with tables for vendors and a large electronics flea market. Overnight camping will be available (small fee). Picnic-style BBQ chicken will be served. Talk-in on 147.81/.21 and 146.52. For more information, send an SASE to Donn Laird WB9YIT, PO Box 330, Angola IN 46703.

INDIANAPOLIS IN
AUG 4

The WA9SNT Amateur Radio Club will sponsor its annual swapfest on Sunday, August 4, 1985, from 8:00 am to 4:00 pm, at the ITT Technical Institute, 9511 Angola Court (across 465 from Pyramids), Indianapolis IN. Flea-market setup will begin at 6:00 am. Admission is $2.00; students $1.00. Flea-market space will be $1.00 additional. Special features include a large flea market, an electronics equipment auction, and refreshments. Talk-in on 146.94 and 3.910 plus or minus. For additional information, contact Dave Johnston

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K9HDQ, c/o ITT Technical Institute, 9511 Angola Court, Indianapolis IN 46268; (317)-875-8640.

WORLD POLICE/FIRE GAMES
AUG 4–7

The San Jose State University ARC will operate W6YL to commemorate the 1985 World Police/Fire Games. Operation will be from: 1900 UTC August 4 to 0700 UTC August 5; 1900 UTC August 5 to 0700 UTC August 6; 1900 UTC August 6, to 0700 UTC August 7. There will also be some operation August 7 through 11. Frequencies will be 3.870, 7.240, 14.270, and 147.555 for phone; 7.125 and 14.040 for CW. For a special certificate, send a large SASE to SJSU ARC, c/o Student Programs and Services, Box 2, San Jose State University, San Jose CA 95192.

ROCKFORD IL
AUG 9–10

The Antique Radio Club of Illinois will sponsor Radiofest 85 on August 9–10, 1985, at the Clock Tower Inn, Rockford IL. Events include a two-day swap and sell session, presentations on Atwater Kent, radio restoration, and Reginald A. Fessenden. A display of radio advertising will also be featured. The convention will conclude with a banquet and awards presentation. For more information, write Joe Willis, PO Box 14732, Chicago IL 60614.

MONSTER OF WALGREN LAKE
AUG 10

The Pine Ridge Amateur Radio Club will operate W6FLO from Hay Springs NE, the home of the famous monster of Walgren Lake, on August 10, 1985. The operation will start at 1700 UTC and run until 2400 UTC, 35 kHz up from the bottom of the General-class phone bands, 80–15 meters. For a special commemorative QSL, send a large SASE to N9BUN, H.C. 56, Box 191, Hay Springs NE 69347.

CHARLOTTE VT
AUG 10–11

The Burlington Amateur Radio Club, Inc., will sponsor its annual BARC International Hamfest at the Old Lantern Camp Grounds in Charlotte VT on Saturday and Sunday, August 10–11, 1985. Admission is $4.00 per person for both days, with children under 12 going free. Flea-market space outdoors will cost $2.00. Flea-market space indoors will cost $5.00. For information on overnight camping, contact campgrounds. Activities will include an R/C model airplane show and a CAN-AM tug-of-war. Talk-in on .34/.94, .01/.61, and .52. Please direct queries to Roger WA1OZE, and flea-market space queries to Bob W1DQO, both at Box 312, Burlington VT 05402.

BROOKFIELD ZOO
AUG 10–11

The Chicago Suburban Radio Association will operate special-event station N9BT from the Brookfield Zoo, Brookfield IL, to celebrate the zoo's annual Country Fair Days. Operation will be on August 10th and 11th, from 1500 UTC to 2300 UTC, using the phone frequencies of 146.55, 14.250, and 7.250 MHz. A special QSL card featuring the zoo's Clydesdale draft horse team will be sent to stations that send their QSL card and a #10 SASE to: N9BAT Special Event, PO Box 88, Lyons IL 60534.

CANYON TX
AUG 10–11

The Panhandle Amateur Radio Club will sponsor its 11th annual PARC-Golden Spread Hamfest on Saturday and Sunday, August 10–11, 1985, beginning at 9:00 am on Saturday and 11:00 am on Sunday, at the West Texas State University Activities Center, Canyon TX. Admission at the door is $7.00. Pre-registration is $6.00. There will be commercial distributors, dealers, and a flea market. AMSAT will be represented and upgrading exams will be administered. For further information, contact Rusty Jessup NU5P at (806)-383-0618 evenings, or write PARC Hamfest, Box 1524, Amarillo TX 79105.

MARION IN
AUG 11

The Grand County Amateur Radio Club will sponsor its 6th annual hamfest on Sunday, August 11, 1985, at the 4-H Fairgrounds, Marion IN. This ARRL event will open its doors at 8:00 am, featuring refreshments, free parking, and license exams. Table reservations are $2.00 per 8-foot table. Donation will be $2.00 in advance, $3.00 at the gate. For further information or tickets, send an SASE to Brooks Clark WB9EAP, 2202 South Boots Street, Marion IN 46953.

SONOMA CA
AUG 11

The Valley of the Moon Amateur Radio Club will hold its 5th annual "Ham" breakfast and swapmeet on Sunday, August 11, 1985, at the Sonoma Community Center, 276 East Napa Street, Sonoma CA, from 9:00 am to 4:00 pm. Admission will be $1.00. Swap tables can be set up from 8:00 am, with swap spaces renting for $5.00 each. Plan on bringing your own table, as there are limited tables available. An all you can eat breakfast will be served from 9:00 am to 11:30 am ($5.00). There will be an open auction beginning at 1:00 pm. Displays will include RTTY, computers, high- and low-band stations, an ARRL forum, our club/police department emergency communications van, slide shows, and dealer displays. Talk-in on 147.47 simplex and the local 144.65/145.25 and 146.13/.73 repeaters. The mission museum, historic Sonoma Plaza, and the Sebastiani winery are all within a short two-block walk. For reservation of swap spaces or for further information, call Darrel Jones WD6BOR at (707)-996-4494, or write him at 358 Patten Street, Sonoma CA 95476.

SOUTH CHARLESTON WV
AUG 11

The first annual Charleston Area Hamfest and Computer Show will be held on Sunday, August 11, 1985, from 9:00 am to 4:00 pm, at the South Charleston Community Center (Interstate 64, Exit 54). Admission is $3.00. Flea-market spaces are $5.00. There will be an all-indoor flea market and an indoor pool will be available. Scheduled events include technical and DX forums. Dealer setup is on Saturday, August 10. Talk-in on 146.28/.88 and 146.52 simplex. This is an ARRL-sanctioned hamfest. For further information, send an SASE to Mac McMillian, 2537 Larwood Drive, Charleston WV 25302; (304)-346-6006. Dealers contact Terry Sanner, 218 Forrest Circle, South Charleston WV 25303; (304)-744-0198.

GEORGETOWN KY
AUG 11

The Bluegrass Amateur Radio Society will sponsor the Central Kentucky ARRL Hamfest on Sunday, August 11, 1985, from 8:00 am to 5:00 pm, at the Scott County High School, Longlick Road and US Route 25, Georgetown KY. Tickets are $3.50 in advance and $4.00 at the gate. There is no charge for outside flea-market space. Features will include technical forums, license exams, awards, and exhibits—all in air-conditioned facilities. Talk-in on .76/.16. For more information or tickets, send an SASE to Scott Hackney KI4LE, 629 Craig Lane, Georgetown KY 40324.

WILLOW SPRINGS IL
AUG 11

The Hamfesters Radio Club, Inc., will sponsor their 51st annual hamfest on Sunday, August 11, 1985, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL, southwest of Chicago. There will be an exhibitor pavilion and the famous swappers row. Tickets at the gate will cost $4.00; in advance $3.00. Talk-in on 146.52. For tickets, mail check or money order to Hamfesters, PO Box 42792, Chicago IL 60642.

ST. CLOUD MN
AUG 11

The St. Cloud Amateur Radio Club will hold a hamfest on August 11, 1985, at the Sauk Rapids Municipal Park, on the north edge of Sauk Rapids off MN Highway 15 (Benton Drive). Displays, demonstrations, and trades will be featured. Tickets will cost $3.00. There will be a snack counter. Talk-in on .34/.94 primary, .615/.015 secondary. For further information contact SCARC, Box 141, St. Cloud MN 56302.

DALTON MA
AUG 11

The Northern Berkshire Amateur Radio Club will sponsor a hamfest on Sunday, August 11, 1985, beginning at dawn, at the Dalton American Legion, Route 9, Dalton MA. Admission is $1.00, with XYLs, YLs, and children admitted free. A few tables will be available at no charge on a first-come, first-served basis. Food will be available. Free overnight camping will be permitted on Saturday night (August 10) beginning at 6:00 pm. Talk-in on 146.91.

BREWSTER NY
AUG 17

The Putnam Emergency Amateur League (PEARL) will sponsor its annual Electronics Extravaganza on Saturday, August 17, 1985, from 9:00 am to 4:00 pm, at the J. F. Kennedy Elementary School, Brewster NY. General admission will be $2.00; tables will be $5.00. Walk-in license exams will be given on a first-come, first-served basis. Talk-in on 144.535/145.135. For advance table registration and information, contact R. Dillon N2EFA, RFD #7, Noel Court, Brewster NY 10509.

GREEN BAY WI
AUG 17

The Green Bay Mike and Key Club's Summer Swapfest will be held on Saturday, August 17, 1985, at the Ashwaubenon Community Center, Anderson Drive, located across from Baypark Square Mall (take the Oneida Street Exit off either Hwy. 172 or US Hwy. 41). There will be free admission and parking. Doors open at 8:00 am. 8-foot tables are available by reservation at a charge of $5.00, with a 4-table limit. For further information, contact Bill Johnson N9CNO, 2177 Orrie Lane, Green Bay WI 54304; (414)-494-8948.

OAKLAND NJ
AUG 17

The Ramapo Mountain ARC (WA2SNA) will hold its 9th annual flea market on August 17, 1985, at the Oakland American Legion Hall, 65 Oak Street, Oakland NJ, just 20 miles from the GW Bridge. Indoor tables will be $6.50; tailgating will be $3.00. Admission is $1.00; non-ham family members are free. Talk-in on 147.49/146.49 and .52. For more information, contact Tom Risseeuw N2AAZ, 63 Page Drive, Oakland NJ 07436; 337-8389 after 6:00 pm.

TACOMA WA
AUG 17–18

The Radio Club of Tacoma will sponsor Tacoma Hamfair-85 on August 17–18, 1985, at Pacific Luthern University, Tacoma WA. Registration is $5.00. Flea-market tables are $15.00 per day or $20.00 for two days (includes one registration). Features include technical seminars, forums, travelogues, a large flea market, license exams, alternate activities, and a dinner ($8.00). Dormitory rooms are $14.00 for a single room and $21.00 for a double room. For more information or to register, write to Grace Teitzel AD7S, PO Box 45079, Tacoma WA 98445, or call Eva Anderson WB7QNS at (206)-564-8347.

HUNTSVILLE AL
AUG 17–18

The Huntsville Hamfest will be held on Saturday and Sunday, August 17 and 18, 1985, at the Von Braun Civic Center in Huntsville AL. There will be no admission charge. Flea-market tables will be available for $5.00/day and should be reserved prior to the hamfest. There will be exhibits, forums, and non-ham activities. Walk-in FCC exams will be given at the Huntsville High School cafeteria beginning at 9:00 am, Saturday, August 17. Tours of the Alabama Space and Rocket Center will be available for the family. A limited number of camping sites with hookups are available at the VBCC on a first-come, first-served basis. Talk-in on .34/.94. For more information, write Huntsville Hamfest, 2804 S. Memorial Parkway, Huntsville AL 35801.

BLOSSBURG PA
AUG 18

The Tioga County Amateur Radio Club will hold its 9th annual hamfest on Sunday, August 18, 1985, from 9:00 am to 5:00 pm, at Island Park, just off Route 15, Blossburg PA. Admission is $3.00 per person; XYLs and children are free. Exams will be given on a walk-in basis. For exam information, write TCARC, PO Box 56, Mansfield PA 16933. There will also be a flea market, dealers, snack bar, and a park and pool for children. Talk-in on 146.19/.79 and 146.52. For further information, contact Durwood Learn WB3DKZ, 11 Bryden St., Wellsboro PA 16901; (717)-724-5613.

LAFAYETTE IN
AUG 18

The Tippecanoe Amateur Radio Association will hold its 14th annual hamfest on Sunday, August 18, 1985, beginning at 7:00 am, at the Tippecanoe County Fairgrounds, Teal Road and 18th Street, Lafayette IN. Admission is $3.00. Features will include a flea market, dealers, and refreshments. Talk-in on .13/.73 or .52. For tickets or for more information, write the Lafayette Hamfest, Route 1, Box 63, West Point IN 47992.

WARREN OH
AUG 18

The annual WARA hamfest will be held on Sunday, August 18, 1985, beginning at 8:00 am, at Kent State University (Trumbull Campus). The flea market opens at 6:00 am. Tickets will be $2.50 per adult in advance and $3.00 per adult at the gate. Children under 12 years of age go free. There will be a large XYL room, talks, crafts, programs, and refreshments. For information or advance tickets until August 1, 1985, please QSL WARA, c/o KD8KJ, PO Box 809, Warren OH 44484.

VJ DAY 40TH
AUG 18-19

The DuPage Amateur Radio Club will be operating special-event station W9DUP in honor of the 40th anniversary of VJ Day. Operating hours will be from 1300 UTC on August 18, 1985, until 0200 UTC on August 19, 1985, from the deck of the submarine, *USS Silversides*, which is docked as a War Museum alongside Navy Pier in Chicago. Frequencies will be 14.240 and 7.240 MHz. For a special submarine QSL card, send an SASE to W9DUP, PO Box 71, Clarendon Hills IL 60514.

WASHINGTON DC
AUG 22-24

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held August 22–24, 1985, in Washington DC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

ITHACA NY
AUG 24

The Tompkins County Amateur Radio Club will sponsor the Finger Lakes Hamfest on August 24, 1985, 12 miles north of Ithaca NY on Route 96. There will be a flea market, dealers, programs, and free overnight camping. Talk-in on .37/.97. For more information, contact David Flinn W2CFP, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARYSVILLE OH
AUG 25

The Union County ARC will sponsor its 9th annual hamfest on August 25, 1985, from 6:00 am to 4:00 pm, rain or shine, at the fairgrounds in Marysville OH. Admission is $3.00 at the gate, $2.00 in advance. Children and XYLs are admitted free. Flea-market space is $1.00 per 10-foot space. There will be overnight camping permitted on Saturday night. Food will be available. For further information, contact Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040; (513)-644-0468.

ST. CHARLES MO
AUG 25

The St. Charles Amateur Radio Club will sponsor a hamfest on Sunday, August 25, 1985, at the St. Charles City Hall complex, 200 North 2nd Street, St. Charles MO, rain or shine (it's under cover). Tickets will cost $1.00 in advance, $1.50 at the door. Parking will cost $1.00. There will be a giant flea market, commercial vendors, programs for XYLs, FCC exams, and food. Talk-in on 146.07/.67 and 146.52. Tickets are available from Denise WD0CZE, 121 Barkwood Trail, St. Charles MO 63303.

SAGINAW MI
AUG 25

The Five County Swap-N-Shop Committee of Michigan, made up of members of amateur-radio clubs from Bay, Saginaw, Genessee, Lapeer, and Shiawassee Counties, will sponsor their ninth annual Swap-N-Shop on Sunday, August 25, 1985, at the Saginaw Civic Center, Saginaw MI. Advance tickets will cost $2.00; tickets at the door will cost $3:00. Table rental is $7.00 per table (tables are 3 feet by 8 feet). There will also be a covered trunk sales area at $3.00/car. Advance ticket orders and table reservations may be sent to Five County Swap-N-Shop, PO Box 2204, Saginaw MI 48605; (517)-777-8683.

BLUEFIELD WV
AUG 25

The East River Amateur Radio Club, Inc., will sponsor the Bluefield Hamfest on Sunday, August 25, 1985, from 9:00 am to 3:00 pm. Activities will take place at the Brushfork Armory-Civic Center, one mile north of Bluefield, West Virginia, on US 52. Admission will be $4.00 per person with children under 12 admitted free. There will be a large indoor flea market, amateur-radio dealers, computer dealers, satellite TV, and various specialty dealers. License exams will be given. Food and paved parking will be available. Talk-in on 144.89/145.49 and 146.52 simplex. For more information, write Jim Perdue KC8NG, Rt. 5, Box 457, Bluefield WV 24701.

HERSHEYPARK PA
AUG 25

The Central Pennsylvania Repeater Association, Inc., will sponsor its 12th annual Hamfest/Computerfest on August 25, 1985, adjacent to Hersheypark, Chocolate Town, USA. Registration will be $3.00. Children 12 and under are free. There will be special reduced admission to Hersheypark available for registrants and their families. There will be a large indoor dealer and flea-market area and a large outdoor tailgate area. Food and refreshments will be available. Talk-in on 145.47 repeater or 146.52 simplex (WA3KXG). For further information, contact Paul W. McDonnell N3BKI, (717)-697-1880 from 12:00 noon to 8:00 pm.

OK CORRAL
TOMBSTONE AZ
AUG 31-SEP 2

Special-event station W7GV will operate from the 4th annual Rendezvous of the Gunfighters, on Labor Day weekend, from the OK Corral, Tombstone AZ. The OK Corral was the site of the shoot-out between the Earp and Clanton factions in 1881. W7GV is the oldest active amateur-radio call in the state. Operations will begin at 1500 UTC, August 31, and will run through 2200 UTC, September 2. Frequencies will be: SSB—28680, 21380, 14280, 7280, and 3730; CW—21130, 7130, and 3730. A certificate will be awarded to all who work W7GV, as well as SWLs. Please send a large 8-1/2 × 11 SASE (40 cents postage) to W7GV, PO Box 36032, Tucson AZ 85741.

BLOOMINGTON IN
SEP 1

The 8th annual Bloomington Hamfest will be held on Sunday, September 1, 1985, from 8:00 am until 2:00 pm, at the 147.18/.78 repeater site, 2335 Vernal Pike off SR 37 bypass. Admission is $2.00. Food will be available. There will be no charge for selling; bring your own table. For FCC VE exams, contact K9PS for details and exam times. For further information, send an SASE to Bob Myers K9KTH, 306 S. Fairview St., Bloomington IN 47401; (812)-332-1105.

WINDSOR ME
SEP 7

The Augusta Emergency Amateur Radio Unit will sponsor the 1985 ARRL-sanctioned Windsor Hamfest on Saturday, September 7, 1985, at the Windsor ME Fairgrounds. Gate donation is $1.00, and camping is $3.00 per night or $5.00 for two nights. There will be a flea market, programs, speakers, commercial distributors, light meals, and the traditional Saturday bean and casserole supper. Talk-in on 146.22/.82. For further information, contact Ron Dishman N1CMZ, 37 Marlboro Avenue, Augusta ME 04330; (207)-623-8351.

UNIONTOWN PA
SEP 7

The Uniontown Amateur Radio Club will hold its 36th annual Gabfest on Saturday, September 7, 1985, on the club grounds located on the Old Pittsburgh Road, just off Rt. 51 and the 119 bypass, in Uniontown PA. Registration is $3.00 each or 2 for $5.00. There will be free parking, free coffee, and free swap and shop with registration. There will be plenty of good food at the refreshment stand. Talk-in on 147.645/.045 and 144.57/.17. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, PO Box 433, Republic PA 15475; (412)-246-2870.

HANCOCK COUNTY OH
SEP 8

The Findlay Radio Club will sponsor the 43rd annual Findlay Hamfest on Sunday, September 8, 1985, from 6:30 am to 5:00 pm, at the Hancock County (Ohio) Fairgrounds. Tickets are $3.00 in advance and $4.00 at the door. Tables are $6.00, and outdoor flea-market spaces are $3.00. Talk-in on 147.75/.15. For more information, contact the Findlay Radio Club, PO Box 587, Findlay OH 45839.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

MONETT MO
SEP 8

The Ozarks Amateur Radio Society will sponsor the 4th annual Ozark Amateur Radio Club Congress and Swapfest at City Park, junction of US Highway 60 and Missouri State Highway 37, Monett MO, on Sunday, September 8, 1985. There will be a swapfest at 11:00 am and a buffet dinner at 1:00 pm. No tickets are necessary. All amateurs and families are welcome. Talk-in on 146.37/.97 MHz, 146.52 MHz, and 7.250 MHz. For more information, write or call the Ozarks Amateur Radio Society, Box 327, Aurora MO 65605; (417)-678-5330.

VIRGINIA BEACH VA
SEP 21-22

The Tidewater Radio Conventions, Inc., is sponsoring the 1985 ARRL Virginia State Convention and 10th annual Amateur Radio-Computer Fair on Saturday and Sunday, September 21 and 22, 1985, from 9:00 am to 5:00 pm, at the Virginia Beach, Virginia, Pavilion. Advance admission tickets for both days are $5.00. Tickets at the door will be $6.00. Flea-market tables will be $5.00 for one day, $8.00 for both days. Featured activities include dealers, special displays, forums, computer equipment, ARRL license exams, free XYL bingo, and movies for the kids. For information and tickets, write or call Jim Harrison N4NV, 1234 Little Bay Avenue, Norfolk VA 23503; (804)-587-1695.

PEORIA IL
SEP 21-22

The Peoria Area Amateur Radio Club will sponsor Superfest 85 at the Exposition Gardens, W. Northmoor Road, Peoria IL, on Saturday and Sunday, September 21–22, 1985. Gates open at 6:00 am; the commercial building will open at 9:00 am. Admission will be $3.00 in advance and $4.00 at the gate. Children under 12 are free. Activities will include amateur-radio and computer displays, a huge flea market, FCC exams for all classes on Saturday only, and a free bus to Northwoods Mall on Sunday. There will be full camping facilities on the grounds. Talk-in on 146.16/.76 (W9UVI). Information or reservations are available for an SASE to Superfest 85, PO Box 3461, Peoria IL 61614.

UPSTATE NY
LICENSE CLASSES

Amateur-radio training programs for all license classes are scheduled to start in the fall in four New York areas: Potsdam-Canton, Fort Covington-Hogansburg, Malone, and Saranac Lake-Lake Placid. For a complete schedule, contact the Program Coordinator, Al Lapier W1CSF, Duane Road, Mountain View NY 12963; (518)-483-0046.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

Does anyone have coils or information for an Eico grid-dip oscillator?

Jon Danford
2115 Joplin
Joplin MO 64801

I need a service manual for the Azden PCS-3000 transceiver, especially the alignment instructions. I will be happy to pay for copies and postage.

Ruben Sanchez XE1RSE
Esteros 18 Las Aguilas
01710 Mexico, D.F.
Mexico

BE MY GUEST

Guest Editorial by Joan Tanya Chopin WA6BXT

GIVE A HOOT

As a rag-chewer, I am continually appalled by the habits of contesters. Day after day I use the 40- and 80-meter bands and take care of them as if they were my own. Then suddenly a contest weekend arrives and the bands are wall to wall with contesters who use the bands for contests only and often treat them unkindly.

I can understand the frenzied pace during a contest that would prevent the avid users from keeping things tidy, but what about later? The day following a contest is the most depressing.

The frequencies are littered with worn-down pencils, crumpled scratch paper, used chewing gum stuck under the Novice band, cigarette butts, a dupe sheet here and there, empty coffee cups, and occasionally a random contester in a comatose state sprawled across 10 or 20 kHz. It is a *disgrace!* Some even have a twitch remaining in their sending hand. Even the most spirited CQs won't awaken them. This is particularly evident after a two-day contest. The longer the contest, the more mess is left. I once found a stale donut just inside the Extra portion of the 80-meter band a week after a Sweepstakes CW weekend.

Why must they be so sloppy? And if they must, why can't they clean up after themselves? Perhaps one reason is that many of them aren't using their own calls during contests so they feel somewhat anonymous. "Who will know if I just leave this soft drink can here? No one can identify me, anyway."

Often they do their operating in the wee hours of the night and steal away into the darkness, never to be seen again until the next contest. Some do operate for the entire contest period, but as soon as the rubber clock strikes 0000 UTC, they hit the road with nary a glance at the messy frequencies they are leaving behind.

In all fairness I suspect that many of the contesters don't even realize the error of their ways. They are operating with such fervor that they are thinking of nothing but Qs and multipliers at the time. I suppose it is incumbent upon us regular users of the bands to educate these folks.

Perhaps we should post signs before the contest begins reminding them of their obligations to clean up their mess. Maybe it should be written into the rules: 42 hours of operating time, 6 hours to clean up the frequencies. It might be effective to build the reminders into the contest exchange: "NR 562, SCV, don't litter."

I must admit that I have not seen much vandalism of the bands. The disasters are always reparable, except for one "KB" apparently etched with a soldering gun which I discovered on the 40-meter Novice band just after the Novice Roundup a few years ago. This faded away in time and was fortunately an isolated incident.

I guess the greatest hope of finding a solution to this problem is to turn to those contesters who also operate during non-contest times. Though I cannot say for sure, I suspect they tend to have fewer offenders among them. These are the hams who are active in traffic, DX, or rag-chewing between contests and they, too, are faced with the aftermath on a Sunday night following a contest.

Perhaps we could recruit contesters who are public-service-oriented hams to take turns patrolling the bands during contests and report violators to a net control who could then issue reminders to the offenders before the contest was over. After a few warnings, offenders could be required to be on a clean-up committee. This would serve to make the contesters more aware of their responsibilities as well as create a clean-up crew to tend to the tidying up.

However it is handled, it should be the responsibility of the contesters themselves to leave the bands as they found them, rather than expect us overworked rag-chewers to clean up after them. Nobody is begrudging them their fun, but let's add some class to the act!■

Joan Tanya Chopin WA6BXT is a freelance writer from San Carlos, California. A teacher of hearing-impaired children, she is also an avid CW rag-chewer and occasional DXer.

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

Welcome to the exciting, diversified, and often unpredictable world of VHF/UHF hamming! For many of you, this column may be your introduction to the world above 50 MHz. For others, it may serve to help you enjoy your casual use of these bands. Seasoned, experienced operators will be helped to use these frequencies to their full potential.

Enjoy building antennas? How about DX arrays (with over 16 dB of gain) that will fit in your living room! Is chasing DX your thing? OSCAR makes it easy—anywhere in the world. Are you into computers? Packet radio on 220 MHz is up and coming fast! Or maybe amateur television (ATV) is your bag. See you on 439.25 MHz!

The frequencies above 50 MHz offer unlimited possibilities. Virtually every licensed ham now has privileges to operate these bands (except Novices, and they may change yet), and that includes *all* modes—CW, SSB, FM, AM, RTTY, ATV, pulse, packet, and satellite. You name 'em, they're here and *thriving*.

Before I go further, a few words about myself are probably in order. I've been licensed since 1970 and hold an Extra-class license. My first love was, and still is, building. I particularly enjoy constructing antennas, amplifiers, and knickknacks such as the VHF/UHF wattmeter that appeared in September, 1984, in *73*. Currently, I'm active on 144 MHz, 220 MHz, 432 MHz, and 1296 MHz. Equipment for 50 MHz will be on the air by the time you read this.

Enough about me! I want to hear from *you*. About your station, operating habits, DX chased, favorite modes, and any technical or operating hints that could be of use to all readers of this column. Don't be bashful! Send photos if you've got them. Black and white are best, preferably 5 × 7 or 8 × 10. If you've got a really great color shot, however, send it anyway as I have the facilities to convert color shots to black and white here. This column is meant for *you* to enjoy and the best columns have input from all readers.

I hope to keep you informed about new products of interest to the VHF/UHF enthusiast, and there are certainly enough of them on the market. If you've got something new—antennas, transceivers, amplifiers, converters, preamps—write me and tell me about it. Word of mouth sells more equipment than you can imagine (and can also turn people off to a brand if it just can't make the grade). I'll try to be as objective in these reviews as I can. If something isn't appropriate or worth the money, I'll let you know. However, if there's a fantastic new transverter on the market, you bet I'll tell you about it.

As far as technical articles go, I'll try to avoid getting too technical. *73* readers prefer straightforward how-to-build-it articles. Great! I never spend too much time on the calculator if I can help it. Topics to be covered will include feedlines, preamplifier gain vs. noise figure, multimode radios vs. transverters, solid state vs. tubes, and, most importantly, understanding the types of propagation that make these bands so unique and exciting to use.

Being an active member of the Society of Contest Operators and Radio Experimenters (SCOPE), I love VHF/UHF contests. Here's a perfect way to test out that new 432-MHz preamp or 50-MHz beam. And you don't have to spend a fortune to get on and have some fun. A reasonably equipped station for 144 MHz need not cost more than about $500–$600 brand new (multimode transceiver, beam, and 100-Watt amplifier). Older equipment can be pressed into service at an additional savings if need be. And you can always build your own antennas if you feel ambitious.

Perhaps the best way to kick off this month's column is to quickly discuss the nature of the commonly used VHF/UHF bands in this country—50 MHz (6 meters), 144 MHz (2 meters), 220 MHz (1.25 meters), 432 MHz (70 centimeters), and 1296 MHz (23 centimeters). These bands constitute the bulk of amateur VHF/UHF activity today. There is activity above 1296 MHz, but the lack of equipment, cost of construction, and critical tolerances inherent in operating here put these bands out of the reach of most amateurs in the US and Canada. (In Europe, it's somewhat a different story, with more active stations and a bit more equipment available.)

The first of our VHF allocations starts at 50 MHz (6 meters). Modes used here include SSB (a lot), CW (very little), and FM. Propagation normally is about 50–100 miles with reasonable power and antennas. But the big attraction is the unique effects of four types of propagation: aurora, sporadic E (referred to from here on as E_s), scatter, and F_2 propagation. Any one of these modes can result in some pretty impressive DX! For example, when an *aurora borealis* is present, signals can reflect off the auroral curtain and be received from 500 to 1000 miles away. CW is the preferred mode here because the received signals are quite distorted!

Things really start hopping on 6 meters about late April and early May. This is the beginning of the E_s season, when thunderstorms and severe weather activity cause the E layer of the ionosphere to become ionized. Stations running barefoot multimode radios (25 Watts or so) are suddenly surprised to hear Florida coming through in New Jersey, or California in Illinois. E_s makes it possible by acting like a giant mirror to reflect these signals back to Earth many thousands of miles away!

The last two modes, scatter and F_2, are not as commonly used. The former is quite tricky and requires patience, as you are actually listening for signals reflected from an ionized meteor trail. These "bursts" can be CW or SSB and may last only seconds. Scatter takes a lot of hard work but the results can be worth it—such as England to South America using 100 Watts! F_2 layer propagation is similar to that found on the HF bands, but with the sunspot cycle now in its minimum, F_2 propagation is nonexistent. In the peak season of 1979–1980, New Zealand was worked by WA2VUN in New Jersey with just 80 Watts and a single beam. And you thought 6 meters was only good for TVI, eh?

Next, we turn our attention to 144 MHz (2 meters). This is the most popular and most congested amateur allocation in the entire world! The most popular mode here is, of course, FM. But many users of FM are unaware of the possibilities using CW, SSB, and even OSCAR. Normal propagation using modest equipment is about 30 to 100 miles, depending on your location. But when 2-meter propagation occurs, it's usually in one of three ways: aurora, E_s, or tropospheric propagation. The first two work just as they do on 6 meters, with aurora being a bit more intense on 2 meters. The distance worked can be from 600–1000 miles with moderate power and good antennas. E_s on 2 meters is not as common as on 6 meters but provides equally spectacular results. In 1982, a rare form of E_s called double-hop resulted in QSOs between New Jersey and Wyoming using only ten Watts! *Wow!* More often than not, you'll be able to hook into the southern states from the Northeast and Midwest quite often using this mode. Again, E_s is influenced by severe storm activity and thunderstorm action, usually many miles away.

An excellent study of the effects of severe weather and solar activity on 144-MHz E_s propagation has been published by Sid Leiberman WA2FXB and provides a thorough treatment of the topic. I'd be glad to refer inquiries to Sid if you're interested.

The third form of propagation on two meters usually starts showing up in late July, about the time the E_s season is winding down. How often have you keyed up your favorite repeater on an early August morning and heard two, three, sometimes four squelch tails? That's tropospheric propagation! The troposphere is the part of the earth's atmosphere that generates all our weather. What often happens is that a temperature inversion occurs: As elevation increases in the atmosphere, the temperature drops and then suddenly rises again. When this occurs, these boundaries between cold and warm air will reflect two-meter signals—sometimes for a thousand miles!

Another form of tropospheric propagation is called ducting, and it doesn't occur as often on 2 meters as it does on higher frequencies. We'll touch on this in a moment, but let's take a look at 220 MHz (1.25 meters). The poor 220-MHz band has been

the constant source of discussion and controversy for many years. Commercial interests covet it, and there have been many proposals before the FCC to put a code-free license on 220 MHz. Novices may yet see their long-lost VHF privileges restored some day on this band.

Typical propagation on 220 MHz is usually about 40–80 miles with modest power. It behaves very much like 2 meters, but being higher than Channel 13, the band is subject to less interference than two meters. The primary mode used here is FM and there are more repeaters going on every day. Also, you'll find many SSB and CW stations here. Propagation is limited to mostly tropospheric varieties, but E_S can occur with spectacular results. Channel 13 can be watched for a tip-off of E_S when it occurs.

Aurora will also occur but is rare. Many enthusiasts have tried and successfully worked scatter here as well as 2 meters. EME (Earth-Moon-Earth, or moonbounce) is popular on this band due to the relative inactivity. Note that 220 MHz is exclusively a North American allocation on a shared basis for amateurs. No one else in the world has it, which explains why the big manufacturers haven't come out with multimodes for this band. There just isn't enough of market—*yet*. Don't let that stop you, however, as 220 MHz needs more activity to keep it as an amateur allocation!

Finally, 432 and 1296 MHz. These are truly UHF bands and can be justifiably called "microwaves." Their wavelengths of 70 cm and 23 cm are indeed small, allowing the use of high-gain antennas that take up very little room and are lightweight. Typical DX might be 40–100 miles (not unlike 2 meters) using 100 Watts and a 22-element beam. Scatter is nonexistent here. Some stations have worked aurora on 432 MHz, but it is very difficult! The avid 432 DXer relies mostly on tropospheric propagation, such as that produced by inversions and ducting. Ducting occurs when a layer of cold air is trapped between two layers of warmer air, forming sort of a waveguide effect. Once inside this meteorological transmission line, your 432-MHz signal can skip along for many hundreds of miles before coming back to Earth—often in surprising places.

Modes used on 432 include SSB, CW, FM in the 440–450-MHz portion, and amateur television (ATV) around 439.25. There's plenty of room here since the band is 20 MHz wide! There's also lots of equipment available, as 432 is fast becoming a popular band worldwide.

On 1296 MHz, the same propagation rules apply and the antennas are even smaller for a given gain figure. How about an 88-element antenna with 20+ dB gain weighing only 3 pounds? Feedlines become more critical and beamwidths are narrow. But you can work about 25–50 miles with a good antenna and 5 to 10 Watts. More equipment is coming on the market every day for this band and the prices are dropping. 1296 MHz is truly a band for the adventurous!

That concludes our band summary! Next month, we'll tackle antennas and feedlines for these bands and delve into such topics as why you just can't use RG-58/U on 432 MHz with 2 Watts and expect to work anybody. Send in your contributions, photos, stories, tech tips, or whatever. I'll try to get them in. I'd like our overseas readers to send me information on their doings, especially our friends in Europe, which is a real hotbed of VHF/UHF activity.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

IS DOG X-RAY GOING TO THE DOGS, OR TO THE ARMADILLOS?

DX is like the fireman's dalmatian—neither is quite the same without spots. In the case of DX, the spots we are talking about are 93 million miles away, on the surface of the sun. Or at least, that's where they would be, if there were any. And without the streams of charged particles from sunspots to ionize our upper atmosphere, long-distance communications goes to the dogs.

Just a few short years ago anyone with a converted 5-Watt CB rig and a handful of aluminum could work the world on ten meters. Working all continents was a trivial task. (My best time for WAC with individual contacts was 13 minutes, although on more than one occasion, stations from all six continents on the same frequency could all hear each other—a rarity today.)

The high static and noise levels of the summer season compound the problem of lack of sunspots by wrecking low-band contacts. The few band openings are short, signals weak, and pileups fierce, as more DXers chase fewer DX stations. The poor radio propagation (and prospects for worse) discourage DXpeditions. And conditions are unlikely to improve soon, except for seasonally better propagation in the fall and spring. The last sunspot cycle bottomed out in 1975, which suggests the current cycle will hit minimum sunspots next year. Even after sunspot numbers begin to increase in the late '80s, radio propagation will take years to recover to former levels, if it does at all. The specter of the Maunder Minimum always arises at sunspot minimums. (The Maunder Minimum was a period of almost 50 years when the sunspot number *never* exceeded the abysmal totals that we are experiencing today. 50 years of lousy DX? The mere thought makes my elements droop.) All in all, the future looks bleak for DXers.

So what does the die-hard DXer do? Unplug the key, hang Christmas lights off the tower, and start watching the tube instead of interfering with it? Ugh. What a terrible prospect! Fortunately there is hope for DXers everywhere. There is life without sunspots, even if DXCC takes years instead of months. Here are three suggestions to revitalize your DX enthusiasm: make better use of present resources, set

DON WALLACE W6AM

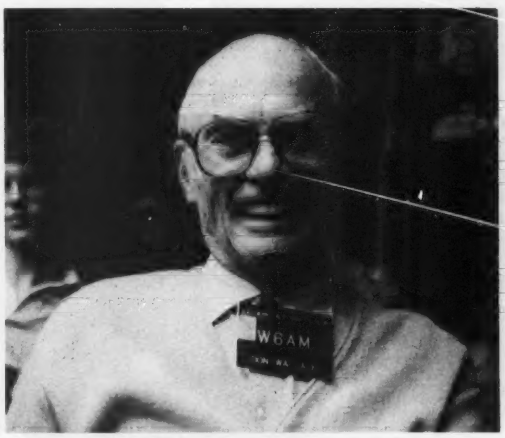
The DX community lost one of its pillars in late May, when Don Wallace W6AM passed away after a lifetime of DXing. Don's DX accomplishments are legend and include DXCC award No. 1, membership in *CQ*'s DX Hall of Fame, and top of the Honor Roll for most of the past 20 years. He was one of the first DXers to earn Worked All Continents, back when such was a considerable feat.

For more than 40 years Don operated from one of the best-known DX locations in the world: the DX ranch at Rancho Palos Verdes, 20 miles from downtown Los Angeles, California. Don's amateur station (he actually lived 10 miles away in Long Beach) was perched atop a 1200'-high hill on a peninsula which sticks out into the Pacific Ocean. The site is one of those near-perfect radio locations about which DXers dream. With a clear shot in every direction (over water in most cases) and with excellent apparent height, the DX ranch effectively pumped out rf on a wide range of frequencies from the amateur bands up through UHF (the latter from a host of business repeaters and equipment on the site). While managing a communications business (including those repeaters), Don assembled a world-class amateur station without a single rotatable beam!

Don's shack featured the best available amateur gear, including many pieces of Collins equipment, sensibly arranged for easy operation. But visitors searched in vain for the rumored high-powered amplifiers that some thought were the keys to the impressive signal of W6AM. Don didn't need illegal power; his nonrotatable-antenna farm was his pileup buster. That antenna farm consisted of 9 separate rhombic antennas, capable of firing DX in eighteen different directions. Where other amateurs turned their rotatable beams, Don flicked switches to select the appropriate rhombic. The dozens of rhombic-supporting telephone poles (some extending to 140') which dotted the 24-acre site gave the impression of a surrealistic forest, with wires instead of leaves on the trees. Appearances aside, nobody laughed when Don transmitted.

For Don Wallace was more than a super station. He was a friendly, helpful amateur who was consistently active in DX through more than four sunspot cycles. There has seldom been a country in the history of DX which Don didn't work. He was always among the first through the pileup, from the very first Clipperton DXpedition (see last month's report) to the latest trip. Don always had a good word for hard-working DXpeditioners. And he was also very active in station maintenance. Unlike some well-to-do amateurs who hire station managers to keep up the antenna farm, Don trotted up and down his forest of telephone poles himself, replacing broken wires, tuning, adjusting. How many amateurs do you know who frequently climbed higher than their ages? While Don did reluctantly give up climbing to the 140′ levels when he was in his 70s, he didn't hesitate to haul his 70+-year-old frame up to the 70+-foot level to repair the intermediate-level antennas.

Even away from the DX ranch, Don was a force on the amateur bands. His mobile kilowatt rig chopped through pileups while Don drove and operated throughout southern California and further afield. His mobile QSL card has a space for "mph" during the QSO. And much of his mobile operation was CW! This writer finds it hard to imagine anyone surviving 40 years of driving around LA, much less running a kilowatt of CW all the time!



Top DXer and rhombic antenna enthusiast Don Wallace W6AM passed away in late May. He will be missed.

Don also shared his station with area hams. Many contesters have enjoyed the fine propagation and unique antenna switching at W6AM. And each June, Don held an Open House at the DX ranch, inviting amateurs from all over to view his shack and rhombics. He often visited DXers' homes during his travels, bringing a touch of DX cheer wherever he went. And Don supported many DX foundations, including serving on the board of some.

Don Wallace W6AM was truly a major force in the DX world. His passing leaves a sincere sense of loss among DXers everywhere. He will be missed by DX and DXer alike.

new DX goals and challenges, and/or redefine DX.

The Conservative Approach

The traditional DXer can make good use of sunspotless summer days by fine-tuning his DX hardware and software. When the bands are hot, the DXer can get away with all kinds of imperfect equipment and operating techniques. But as the sunspots wane, only the best-equipped stations and most careful operators will enjoy consistent DX success. This doesn't mean you have to get a second mortgage on your home to stick up stacked monobanders, but rather that you should make the best possible use of your available DX resources.

Start by tuning up your station, from top to bottom. Realign and tighten antenna elements. Replace that leaking trap which keeps you off 20 meters when it rains. Pay particular attention to your feedline. Even a small water leak under the outer jacket of your coax can seriously corrode the braid. The connection between the feed and the antenna itself is a frequent source of trouble. Consider lobbing off a few feet of feedline and replacing this critical connection. Or take the money you're saving by not sending out many QSL cards and buy some new feedline, eliminating those seven barrel connections between antenna and shack. The feedline between transmitter and antenna may be the most neglected part of your station equipment, and a poorly designed and maintained feedline can rob as much as half of your signal, both transmitting and receiving! Typical problems with coaxial-cable feedlines include too tight taping to tower legs (the tape can crush the cable), long, unsupported runs above the ground (while the coax is out of the way of the lawnmower, the long run stretches and weakens the cable), and water or other contamination inside the cable itself. Watch for tight bends; they create large impedance bumps. Cable manufacturers suggest limiting turns to at least 20 times the coax diameter, or about a 10" circle for RG-8.

Next review the signal patch within your shack. How many connections, meters, tuners, etc., lie between rig and antenna? Every one robs signal strength on both receive and transmit. When 10 meters is wide open, 2 Watts into a bedspring will work the world, but these days every 0.1 dB counts. Finally, check out your rig itself. When was the last time you peaked the receiving circuits? How about the drive circuits? If you're still using those glass bottles with the glowing wires inside, have you neutralized the finals lately? A few hours cleaning and adjusting your DX hardware will pay handsome dividends during the dog days of DX.

Even the best-equipped and most finely tuned station is of little value without the expertise to operate it effectively. The random operating and sloppy techniques that in recent years filled the shack walls with DX QSLs yield nothing but frustration in today's intense pileups. How does the DXer tune up his DXing software? He bones up on propagation, pays particular attention to who is on when, and hones his DX operating skills.

Mastering Propagation Mysteries

Sunspot minimums are excellent opportunities to learn more about the ever-fascinating field of propagation. With signals weak and interference at a minimum, the down-in-the-mud stations are workable by those who know where and when to look. Use the Northern California DX Foundation 20-meter beacon system on 14100 to compare propagation at your station with the propagation charts published each month in *QST*. Check out grayline, trans-equatorial, and other propagation modes by changing the time you operate or by aiming your beam in another direction. Watch 20 meters for the rapidly shortening skip that heralds a 15-meter opening. And don't hesitate to send a CQ on a seemingly empty band.

10 meters, for example, offers a remarkable amount of DXing, even at the dead bottom of the sunspot cycle. The trouble with 10 meters is that everyone listens and nobody transmits. The band always sounds dead. Try a CQ and see what turns up. Once in a while, you will be very pleasantly surprised.

At the bottom of the last sunspot cycle, I was operating from West Africa on 15 meters when I noticed that the skip distance was getting shorter. (In other words, the signal strength of stations closer to me was increasing, a good indication that the next higher band might open.) I switched to 10 meters and tuned hopefully across the band. Nothing. Not even a peep. Facing the prospect of retuning the 17 knobs and switches necessary to get back down to 15 meters, I decided to try a long CQ on the off chance that someone, somewhere, was listening. As I eased my foot off the foot switch after a one-minute CQ, the receiver exploded with a roar. At first I thought I had 40-over-9 power-line noise, but the roar gradually began to resolve into individual callsigns. 10 meters was wide open to Europe and North and South America, but everyone was listening. Until my CQ, the band might as well have been closed. So don't just tune quickly across the band and give up; try a CQ. And listen for the host of 10-meter beacons in the 28200–28300 range.

Another technique to improve your DX payout without sunspots is to pay more attention to who is on when. First you need to know exactly which countries you have confirmed and which you still need. Careful, up-to-date record-keeping is a must (and we'll talk more about this in a future column).

Then turn to the weekly and biweekly DX bulletins, local DX repeater or DX club meetings, or other source of current DX information. Among the other tidbits offered in these sources are vital clues to the operating habits of DX stations in countries you need. Look for regular activity from these countries. Most DX operators get on the air at about the same time each day, and usually at about the same frequency. This regularity may be due to DXers being creatures of habit, or to local conditions such as family obligations, eating and sleeping times, or when electricity is available. Whatever the reason, if a DX station is on the air at a particular time and frequency once, that's an excellent place to look for him again. So peruse "Bandpass" (in *The DX Bulletin*) or "QSN" (in *QRZ DX*) for operating hints. And don't forget any DXpeditions or special operations; they often provide more contact possibilities and better QSL routes than some of a country's regular operators. After all, not every DX station wants to sit and run Ws all day and then face the QSL chores. On the other hand, that's exactly what the DXpeditioner wants. It's the whole reason for the trip so he will be more anxious to pull your call out of the pileup.

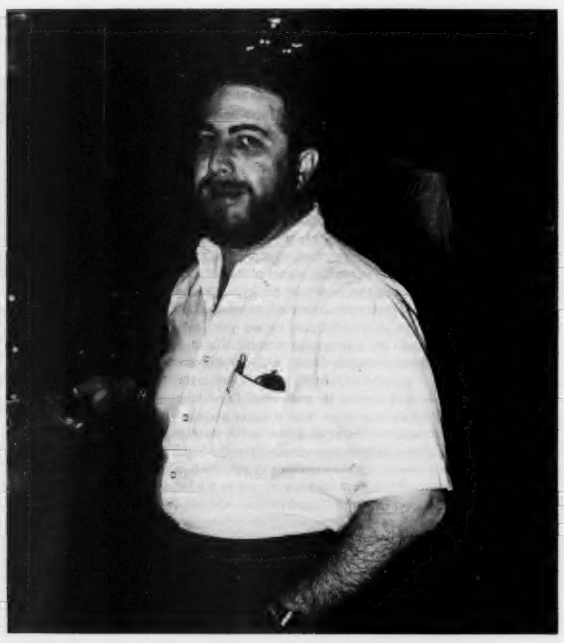
Another way to augment your DX scorecard is to hone your DX operating skills, including listening, pileup busting, and tracking down hunt-and-peck stations. And an excellent way to hone these skills when DX is few and far between is to expand your definition of DX.

Expanding Your DX Horizons

With "traditional" DX becoming increasingly hard to come by, alternate definitions of DX serve to keep the DXing spark alive. Among possibilities the DXer might consider is working DXCC on different bands, especially the lower frequencies. (Use this summer to get up some new, more effective DX antennas for these bands.) Another approach would be to chase DX on our new amateur bands: 10 and 24 MHz. Alas, the ARRL Board of Directors won't allow DXCC credit for contacts on these bands (yet), but DX is there, nevertheless. And the new bands are less crowded, with no QSLs to worry about, since they don't count anyway. These new bands offer a pure form of DX the likes of which we haven't seen for years. Think of the opportunities of starting all over again with a new band! (We'll talk more about the new bands in another column.)

Yet another approach to revitalizing your DXing is to chase awards other than DXCC. Many countries offer handsome certificates for various DX accomplishments, such as working all Japanese cities, 100 members of the German DARC,

K5LZO demonstrates one approach to the armadillo, the national bird of Texas.



1986 Armadillo Run Coordinator Tom Taormino K5RC hopes to activate 3077 counties next year.

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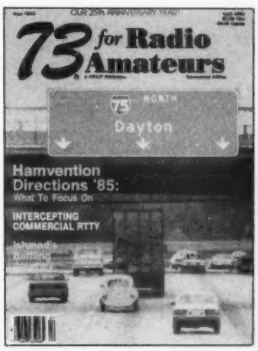

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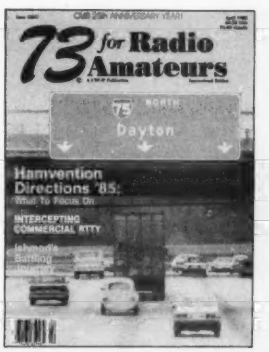

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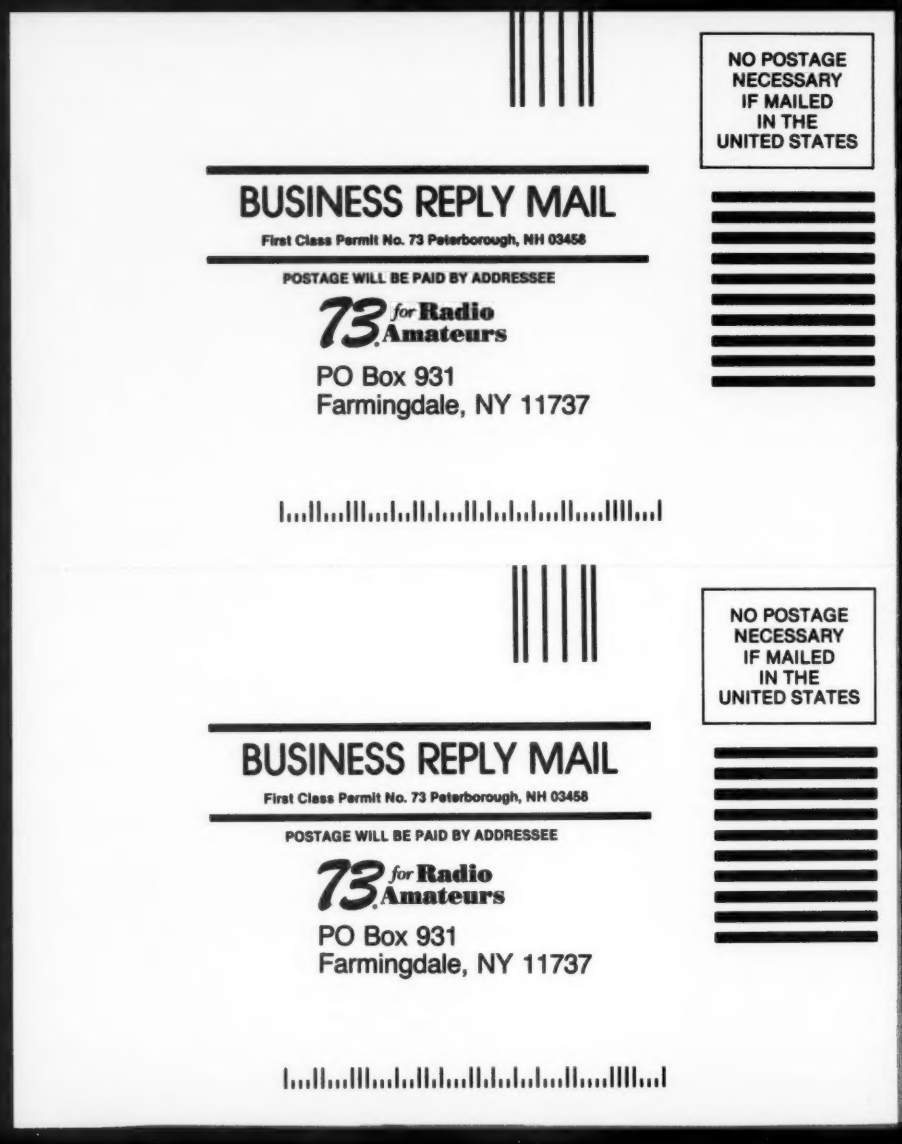
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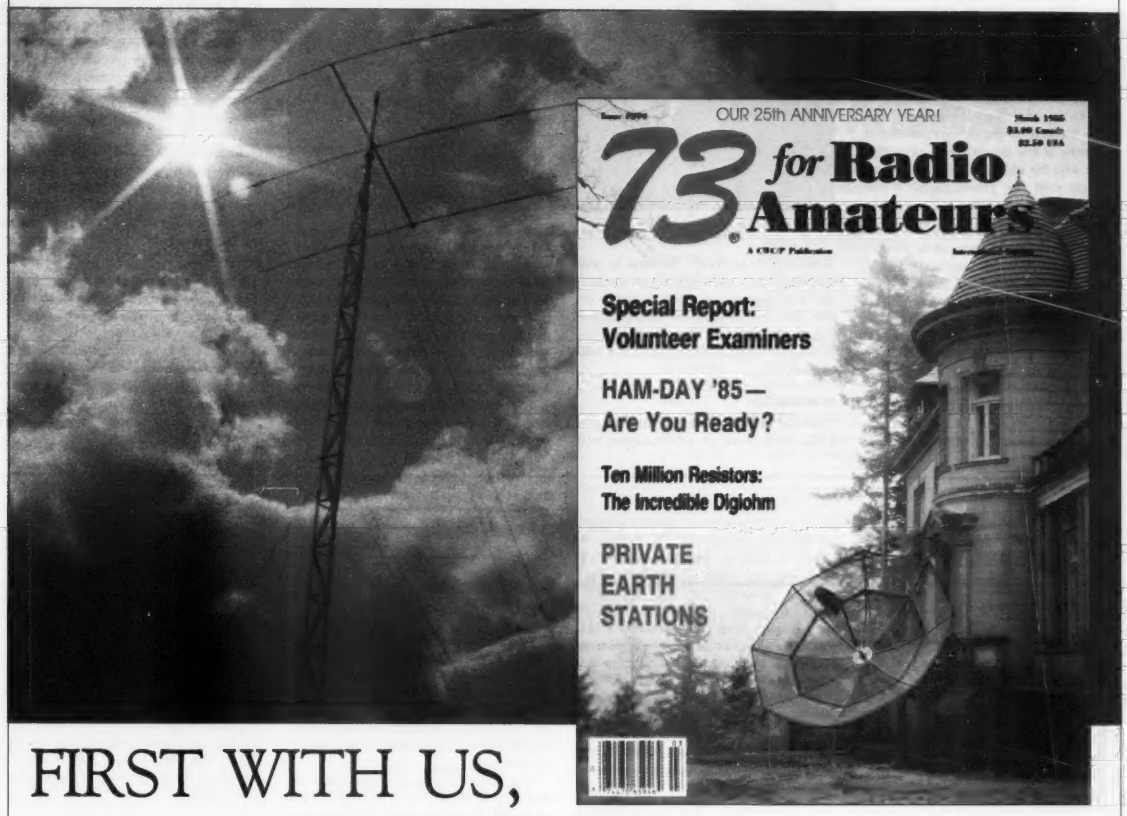

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Russian Oblasts, etc. Or try for the Philippine Worked All United Nations Members award. Since the effective date of contacts for this award is the date of entry into the UN, you'll find you have to go back and work a lot of familiar countries once again to qualify. Contact Pete Peterson K5EDV for more information on this award. Other possibilities include collecting prefixes and islands on the Air, sponsored by *CQ* magazine and Geoff Watts (62 Belmore Road, Norwich, NR7 0PU England), respectively. Both awards will keep you out of trouble until the sunspots return. Or try starting all over with low power. Modern solid-state rigs perform as efficiently at low power levels as at high power. And the additional effort of making contacts with low power places a premium on operating skills.

Finally, you can completely redefine what you mean by DX. How about Worked All States on 10 meters, starting now? To accomplish this before sunspots make it easy will force you to learn more about propagation, operating methods and techniques, and listening. Or go for 5BWAS, to practice low-band DXing and pileup busting. Worked All States not enough of a challenge for you? Then how about working all 3076 counties in the United States? In 44 hours?

"What!" you say. "All 3076 counties in 44 hours? Ridiculous!" Perhaps to ordinary DXers, but not to the Texas DX Society. This very active group invented the Armadillo Run to battle DX doldrums, and they now propose to enlist the rest of the country in a certified amateur-radio happening.

Jim White K1ZX/4 (right) won the 1983 and 1984 Armadillo Runs.

Armadillo Run

Simply put, the Texas DX Society proposes to activate all 3076 counties over two weekends in 1986: May 3–4 and July 26–27. In celebration of the 150th anniversary of the birth of Texas, the 1986 Armadillo Run will demonstrate ham radio's ability to mobilize quickly, help pull amateur-radio clubs together, and provide a couple weekends of fun for patient DXers and contesters.

The bold idea of activating every county in the US grew out of a 1983 Texas DX Society effort to put all 254 Texas counties on the air. With 12 mobile teams, in 22 hours of operating, the members of the society accomplished this goal, and even gave a trip to the ARRL National Convention in Houston to the winner of the 1983 Armadillo Run. That winner, who worked all 254 counties in Texas in one weekend, was Jim White K1ZX/4. Last year the society expanded the activity to include counties in neighboring states. (Again Jim White took top honors, this time from a horizontal operating position, recovering from an automobile accident.)

So these Texas guys have some experience in these Armadillo Runs. Maybe they can pull it off, with the help of other radio clubs around the country. As an added incentive to Run participants, the society expects the governor of the state to proclaim a new county, Armadillo County, for the duration of the Run! That's like having the League create a country just for one contest!

If you are interested in helping in the Run, contact your local radio club or Run Coordinator Tom Taormina K5RC, Route 1, Box 307, Manvel TX 77578.

Even if you're not interested in the Run, it shows what you can do to keep the DX spark burning when the sunspots aren't. What's your Rx for lackaspots-itis? It may just be the Texas National Bird, the armadillo.

LETTERS

STRAIGHT TALK

Your constant battle with the code requirement is well-received by the many who find this *the* difficult part of the license.

To view code as difficult surely means that the person attempting to learn it has set off on the wrong foot. After all, in WW2 thousands of operators were turned out, sausage-like, in very short order.

If the budding operator is taught using 18–20 wpm right at the start, we would produce operators who could go on the air with some confidence and use very much less time per QSO, thus freeing up band space!

To learn code requires a totally different procedure from that used to learn theory—and *this* may be the problem encountered by so many. It should take no longer than 3 months to get to the 15-plus-wpm level. But you must practice two or three times per day, 7 days per week (no excuses). Each practice period should last about 10 minutes. It's very much like learning to touch-type—it's not how much you do, but how often you do it that counts.

Keying with a straight key (yes, they still exist!) is another operation that is performed incorrectly, quite often resulting in undue fatigue and/or poor sending. The key should be at the edge of the desk, never twelve inches or so back from the edge as is so often shown in instructions. Remember I said *straight key*—it's different for a paddle. Sending is done by moving the forearm down at the wrist, thus dragging the key down. Never push it down or the muscle on top of your arm will grumble! Practice without an oscillator connected for a few minutes until you get the dot-dash relationship clear (by the sound of the key clicks) and you should be all set to go. If your sending deteriorates, stop! You will find that your muscles have tensed up and you are pushing the key down instead of dragging it down.

Please don't say it can't be done—I didn't even want to be an operator, and the army had me doing it for 8 hours on and 8 hours off, 7 days per week, under conditions a lot less comfortable than the average ham shack!

Eric Stabler VE3ISD
St. Catharines Ontario

HUZZAH!

While scanning the March, 1985, issue for some info on RTTY equipment, I came upon the guest editorial, "Stop Playing Around." It struck a chord so loud that I had to write and say "huzzah!"

I have spent at least 6 months per year as ZF2BD in Grand Cayman since 1974, and my operating has diminished almost to the vanishing point. I used to go to the shack every evening for 2 to 3 hours to enjoy long QSOs with people from all over the globe. Though I can hardly be called rare DX, in the past several years it has been almost *impossible* to have a conversation of more than 2 minutes without breakers and the subsequent pileup.

In the early part of each winter season I usually answer 20–30 59-QTHers, but by March or April I turn on the rig, have one short contact (who signs off saying there must be dozens waiting), and say the hell with it and throw the switch and go to bed. Anything short of a 30-minute contact is, as far as I am concerned, to be relegated to contests. I want to know about their wife, kids, interests, occupation, and so on. I don't give *diddly* about their store-bought rig or commercial antenna!

William T. Davin M.D. W9YKT
Glen Ellyn IL

DXPENSES

To Warren Ash AK2H
Kingston NY

Warren, my friend, what a bitter letter ("What Price QSL?," June, 1985). I must admit that I don't understand why you didn't receive a QSL from H44IA, but your rather vicious attack on Bryan Sturm is a bit out of line. I recently received a QSL from him with no problem. I used the IRC system.

It is difficult to nearly impossible for any of us in the States to understand the problems encountered by our brethren in the remote corners of the world. Perhaps his mail from you was pilfered, and the pilferer is attempting a little blackmail on you. Perhaps there are other problems, such as the burden of thousands upon thousands of QSL requests which cost a lot to answer. Perhaps Bryan simply cannot answer them all without a little financial support. After all, my friend, various DX clubs support the cost of QSLing for many DX stations that otherwise would not be able to meet the demands placed upon them.

QSLing is a bit of a luxury, to say the least, and not necessarily a burden that should be placed on the DX operator. After a while they will simply quit operating.

Paul Menard W7KZK
St. Meinrad IN

SIGN IN, PLEASE

For the ham who hasn't spent a dime on new equipment in the past decade, it may be quite a shock to view the interior of a state-of-the-art transceiver, but for the rest of us the sight is all too familiar: circuit boards loaded with chips that often have part numbers which don't seem to cross to any in the 74LSxxx series. And while the design and production of ham equipment has advanced nicely over the years, the same *cannot* be said for the troubleshooting and repair of those rigs.

When I was a youngster, troubleshooting consisted mainly of some basic test equipment and the ability to tell the difference between a good and a bad signal. Now, even if I can find a test probe small enough to fit onto the test point without shorting to something else, the trusty scope display is, more often than not, a jumble of digital signals that confuse me as much as they do the triggering circuit! I threw in the towel. The signals on the scope didn't make sense. There was often no theory of operation in the manual, and the test equipment required to troubleshoot this digital stuff was the same equipment used to design it—in a word, unaffordable.

The whole mess didn't seem to make good economic sense either. Why would any technically-competent ham want to purchase equipment knowing in advance that if anything went wrong with the gear, he stood little or no chance of repairing it past the replacement of lamps and fuses? Wouldn't the owner prefer to deal locally with a problem rather than return defective equipment to an often physically, and even more often psychologically, distant manufacturer? Reality provides the answer. All manufacturers now market sophisticated electronic equipment with "no user-serviceable parts inside." No other choice is available.

But then I discovered a troubleshooting tool that gives the average ham/technician a chance at repairing his own gear again. It really put all that microprocessor stuff in its place and restored my faith in the "one hand/one probe" method of making sick rigs well. With this box, all you have to do is set a few internal switches in the device under test, put the probe on the desired point, read the number that appears on the test instrument, and compare it with a known good reading in the technical manual. Right or wrong—what could be easier?

The method is called signature analysis, and although it has a few limitations, in my opinion it's miles ahead of looking at jittery data on a CRT. The basic theory is to lock the microprocessor into a low-level operation (such as a jump to its own

jump instruction) to provide a repetitive signal on its address and control lines. The signature analyzer then samples this signal, does some math, and produces a unique numeric display which represents the sampled data. Any number other than the correct one indicates a fault and troubleshooting can be done with ordinary techniques such as the "half-split" method, the "good input/bad output" method, etc. At least one manufacturer (Hewlett-Packard) is already making the test device itself, an instrument similar in appearance to a common multimeter.

By now you're probably asking, if this is such a great tool, why aren't manufacturers designing equipment to take advantage of it? Frankly, I don't know. Perhaps there is a bug in the theory that no one has bothered to tell me about. Or it could be that the technique is still so new that producers of electronic equipment haven't had time to finalize their implementations. But I refuse to believe that I am fully informed on the latest technology, so I'm not going to hold my breath. Then again, maybe this is one of those ideas like quadraphonic sound—nothing really wrong with it, but it just didn't catch on.

Lee Hughes WA2VPH
Moravia NY

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

SARTG WORLDWIDE RTTY CONTEST
0000 to 0800 UTC August 17
1600 to 2400 UTC August 17
0800 to 1600 UTC August 18

This is the 15th annual contest sponsored by the Scandinavian Amateur Radio Teletype Group (SARTG). Operating classes include a) single operator, b) multi-operator, single transmitter, and c) SWL. Please note that logs from multi-operator stations must contain the names and callsigns of all operators involved. The same station may be worked once on each band for QSO and multiplier credits. Only 2-way RTTY QSOs will count. Use all bands, 80 through 10 meters.

EXCHANGE:

RST and QSO number.

SCORING:

QSOs with your own country count 5 points. Other countries in the same continent are 10 points. Other continents are 15 points. In the USA, Canada, and Australia, each call district will be considered a separate country. Use the DXCC list and the above-mentioned call areas for multipliers. Note that contacts with a station which would count as a multiplier must be found in at least 5 logs or a contest log must be received from the multiplier station in order to be valid. Final score is the sum of QSO points times the sum of the multipliers. SWLs use the same rules for scoring, but based on stations and messages copied.

AWARDS:

Top stations in each class, country, W/K, VE/VO, and VK call district if the number of QSOs is reasonable.

ENTRIES:

Logs must be received by October 10 and should contain: band, date/time in UTC, callsign, exchanges sent and received, points, multipliers, and final score. Use a separate sheet for each band and enclose a summary sheet showing the scoring, classification, callsign, name, and address. In the case of multi-operator stations, include the names and callsigns of all operators involved. Comments will be very much appreciated by the contest committee. Send logs to: SARTG Contest & Award Manager, Jorgen Dudahl-Lasjon OZ1CRL, Egebjergvej 90, 4500 Nykoking Sj., Denmark.

NEW JERSEY QSO PARTY
2000 UTC August 17
to 0700 UTC August 18
1300 UTC August 18
to 0200 UTC August 19

The Englewood ARA invites all amateurs worldwide to participate in the 26th annual NJ QSO Party. Phone and CW are considered the same contest. A station may be contacted once on each band; phone and CW are considered separate "bands" but CW contacts may not be made in phone band segments. NJ stations may work other NJ stations.

EXCHANGE:

QSO number, RS(T), and ARRL section, country, or NJ county.

FREQUENCIES:

1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50–50.5, and 144–146. Suggest phone activity on the even hours, 15 meters on the odd hours (1500 to 2100 UTC), and 160 meters at 0500 UTC.

SCORING:

Out-of-state stations multiply the number of complete contacts with NJ stations times the number of NJ counties worked (21 maximum). NJ stations count 1 point per W/K/VE/VO QSO and 3 points per DX QSO. Multiply total QSO points by the number of ARRL sections (including NNJ and SNJ—maximum 74). KP4, KH6, KL7, etc., count as 3-point DX contacts and as section multipliers.

AWARDS:

Certificates will be awarded to the first-place station in each NJ county, ARRL section, and country. In addition, a second-place certificate will be awarded when 4 or more logs are received. Novice, Technician, and mobile-operator certificates will also be awarded.

ENTRIES:

Logs must show date/time in UTC, band, and emission. Logs must be received no later than September 14. The first contact for each claimed multiplier must be indicated and numbered, and a checklist of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to: Englewood Amateur Radio Assoc., Inc., PO Box 528, Englewood NJ 07631-0528. A #10 size SASE should be included for results.

CALENDAR

Aug 3–4	ARRL UHF Contest
Aug 17–18	SARTG Worldwide RTTY Contest
Aug 17–19	New Jersey QSO Party
Aug 19–25	*Spec-Com* North American UHF FSTV Contest
Sep 14–15	ARRL VHF QSO Party
Sep 14–16	Washington QSO Party
Sep 28–29	Late Summer QRP CW Activity Weekend
Oct 5–6	ARRL QSO Party—CW
Oct 6–7	Illinois QSO Party
Oct 12–13	Rio CW DX Contest
Oct 12–13	ARRL QSO Party—Phone
Oct 19–20	ARRL Simulated Emergency Test
Oct 19–20	Jamboree On The Air
Nov 2–3	ARRL Sweepstakes—CW
Nov 16–17	ARRL Sweepstakes—Phone
Dec 7–8	ARRL 160-Meter Contest
Dec 14–15	ARRL 10-Meter Contest

THE BARK

NEWSLETTER OF THE MONTH

It's such a pleasure to see a newsletter that obviously has had some thought and care put into it. Bob Ward WA5ROE turns out such a paper; he's the editor of *The Bark*, journal of the Big Bend (Texas) Amateur Radio Club (BBARC).

The Bark is not the largest publication we've seen, nor is it the flashiest. What makes this newsletter stand out among all others is *quality*. Congratulations, BBARC.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

THE MISSING GLOW

They were our best friends for decades. Their gentle, reassuring glow illuminated our shacks, warmed our hands, and helped us to transmit our signals across oceans and continents. They were as much a part of ham radio as telegraph keys, antennas, TVI, and QRM. We took them almost for granted until one day, almost without warning, they disappeared. The friendly vacuum tube, our companion through countless billions of QSOs, has called its final QRT. Except for use as a CRT and in some high-powered rf amplifiers, the tube has left us.

I got into ham radio during the tube era's very last hurrah. Back in the mid 1960s, tubes were found everywhere: in transmitters, receivers, converters, power supplies, and mostly in hams' junk boxes. In those days, being a True Ham meant knowing your tubes. The weaker among us relied on tube guides and substitution manuals to pick the right devices for their new projects. We True Hams, however, knew that the 6146 was a workhorse transmitting tube. The new, improved 6146A and 6146B versions were even better.

Today, ham radio is transistorized and microcircuited. Things have changed so much that a ham from even as recent a time as the 1950s would be amazed at the revolution in amateur technology. He would probably ask, "Where'd all the tubes go?"

While I realize our hobby must keep up with the times, I can't help but feel that something went out of ham radio the day the last tube rig was manufactured. Just as Brooklyn's decline can be traced to the day the Dodgers left for the west coast, ham radio's recent rough years are no doubt due to the demise of the vacuum tube.

I keep one in my shack just for good luck.

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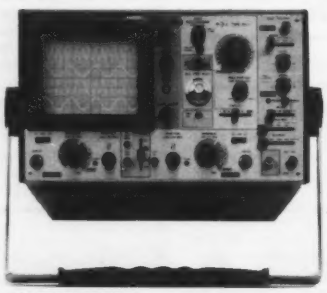

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ELEMENT 1
MULTIPLE CHOICE

1) How can you tell if a tube is "gassy?"
   1) By the tube's orange glow
   2) By a bluish glow between the tube's cathode and plate
   3) By shaking it
   4) By listening for the leak
2) Grid-current flow in a class-A amplifier signifies:
   1) A normal operating state
   2) That the tube is being over-driven
   3) That the tube is being under-driven
   4) That the signal voltage is too low
3) What company made "Reliatron" tubes?
   1) RCA
   2) Sylvania
   3) ITT
   4) Westinghouse
4) What company made "Radiotron" tubes?
   1) RCA
   2) Zenith
   3) Sylvania
   4) Grebe
5) Another term for a grounded-grid amplifier is:
   1) grounded-plate amplifier
   2) plate-driven amplifier
   3) grounded-lead amplifier
   4) cathode-driven amplifier

ELEMENT 2
TRUE-FALSE

		True	False
1)	The British term for "tube" is "jug."	____	____
2)	The two elements in a tube diode are the plate and anode.	____	____
3)	A tube grid is usually solid.	____	____
4)	Tetrode and pentode rf amplifier tubes, when used in a receiver, have a very low plate-to-control-grid capacitance.	____	____
5)	The 6146 has three leads connected to its cathode.	____	____
6)	Mercury-vapor tubes are characterized by their soft orange glow.	____	____
7)	In an "inverted tube," the plate receives the input signal and the control grid delivers the output signal.	____	____
8)	In a multi-anode tube, several main anodes operate opposite a single plate.	____	____
9)	Many tubes are also monodes.	____	____
10)	Magnetron tubes are often used at VHF frequencies.	____	____

ELEMENT 3
MATCHING

Match the tube in Column A with the description in Column B.

Column A	Column B
1) 6A8	A) Voltage regulator
2) 2Y2	B) Photomosaic amplifier
3) 5651	C) Beam power amplifier
4) 6F4	D) Metal receiving tube
5) 5727	E) Miniature receiving tube
6) 5998	F) Gas thyratron
7) 7591	G) Series regulator

8) 6AL7GT H) Triode transmitting tube
9) 6C4 I) Half-wave rectifier
10) 12X4 J) Electron-ray indicator
K) Full-wave rectifier

ELEMENT 4
FILL IN THE BLANK

1) The emission of electrons from a tube's filament to its plate is called the _____ effect.
2) Another term for "plate" is _____.
3) Tetrodes have _____ grid(s).
4) Pentodes have _____ plate(s).
5) An orthicon is a type of _____ _____ tube.

THE ANSWERS

Element 1:
1—2, 2—2, 3—4, 4—1, 5—4.

Element 2:
1—False The British word is "valve."
2—False Plate and cathode.
3—False It's usually a wire mesh.
4—True To help prevent self-oscillation.
5—True To minimize lead inductance.
6—False Bluish-green glow.
7—True The plate is biased negatively and the control grid is biased positively.
8—False Cathode, not plate.
9—False Monodes have only one element, a tube has at least two parts.
10—False At microwave frequencies.

Element 3:
1—D, 2—I, 3—A, 4—H, 5—F, 6—G, 7—C, 8—J, 9—E, 10—K.

Element 4:
1—Edison
2—anode
3—two
4—one
5—TV camera

SCORING

Element 1:
Five points for each correct answer.

Element 2:
Two and one-half points for each correct answer.

Element 3:
Two and one-half points for each correct answer.

Element 4:
Five points for each correct answer.

How did you do?
1–20 points—Your plate supply voltage is out
21–40 points—You've got a grid leak
41–60 points—You're getting warmer
61–80 points—You've been hypnotized by the glow
81–100 points—You're a True Ham

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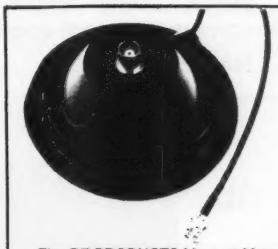
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3- "	160, 80, 40M	60 ft. "	$ 43	"
2- "	80, 40M	40 ft. "	$ 35	"
3- "	NO-TRAP DIPOLE - 160, 80, 40M	113 ft. long	$ 71	"
2- "	80, 40M	85 ft. "	$ 55	"
9-BAND	SPACE-SAVER DIPOLE - 160 thru 10M*	46 ft. long	$ 85	ppd

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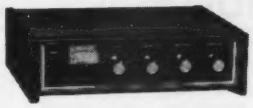

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73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

Here are some snippets, cleaning up scrap pieces of info that have gathered on my desk over a period of time, especially appropriate now that my column may appear on a bimonthly basis.

LICENSE FEES

The annual fee for an amateur license in VK is now $A21, plus postage if applicable. This also is the cost for a reciprocal license, no matter how brief may be your stay in Australia.

FORMAL CELEBRATIONS

A number of Divisions are planning to hold formal celebration dinners this year. During November, 1985, the Administrative Council of the IARU will be holding a meeting in Melbourne prior to the IARU Region 111 Conference in New Zealand. At that time, many important IARU dignitaries will be here, and the committee is planning to hold a national reception.

SPECIAL HIGH-SPEED AMATEUR MORSE TESTS

Our DOC will now provide high-speed Morse tests as a permanent service to the amateur fraternity. The main aim is to assist amateurs to obtain a reciprocal license when visiting overseas countries where Morse speed standards are higher than in Australia. Tests at speeds of 12, 14, 15, and 16 words per minute were utilized during the trial period.

The following conditions are applicable to the new arrangements which are now in force:

- Amateur licensees may apply to sit for high-speed Morse tests at any of the department's Radio Frequency Management offices.
- As with all special examinations, these tests will be provided on a mutual-convenience basis. Tests at any reasonable speed above 10 wpm can be arranged, subject to the availability of a suitable qualified departmental examiner.
- High-speed Morse tests will, in general, follow the same system, in terms of format and marking, as the standard amateur Morse examinations. The exception will be that the Morse character/space ratio will be as described in the ITU Radio Regulations. A pass will be awarded to candidates who achieve 10 or fewer errors in receiving, as well as 5 or fewer errors in sending (e.g., 1 letter wrong equals 1 error, 1 figure wrong equals 2 errors).
- An accreditation document attesting to the candidate's ability in Morse at the appropriate speed will be issued to successful candidates.
- A fee of $20 per test will be applied, in view of the one-off nature of these tests. This fee reflects a realistic balance between the costs of providing the service and its value to interested persons. The level of the fee will be reviewed from time to time.

SCHOOL BOOK PACKS

While the events mentioned above are for existing amateurs, we also are looking to the future by introducing amateur radio to secondary school students.

As this year has been proclaimed the Year of Youth, an event which is sure to gain much more public interest than "World Communications Year," what better time to bring our pastime to the attention of the youth of Australia? As a starter, we are negotiating to make available, at cost price, special amateur-radio Book Packs, which can be purchased by bona fide groups and clubs for presentation to schools. At present, it appears to have great potential for new amateurs (and therefore, future members) as well as providing another bridge between amateurs and the public.

The WIA also is hopeful of running a contest during this year for non-amateur students, with some important prizes being donated by a significent *Amateur Radio* magazine advertiser.

VK8—LADIES

There should be, in the near future, some VK8 YL operators as at the last Novice course conducted by the VK8 Radio Club, 50% of the applicants were young ladies. I hope some pass, as I, personally, have never heard a VK8 YL on the air.

CORDLESS TELEPHONE BAN

The Australian government has banned the import of cordless telephones not approved for use in Australia. Industry and Commerce Minister, Senator John Button, has changed customs regulations due to the import of a large number of cordless telephones which did not comply with DOC regulations. He said the telephones interfered with television reception, and that those using high power also could cause interference to aviation communications.

SPECIAL ENVELOPES

On May 22 this year, our Postal Department issued a special commemorative pictured envelope featuring amateur radio and commenting on the fact that the WIA was celebrating 75 years of existence and was, in fact, the world's oldest national amateur-radio club.

The envelope is quite striking in appearance, featuring an old-type CW key in the foreground, behind which is a circuit diagram of an early radio transmitter. Above this is a dish antenna, plus headphones superimposed over a map of the world showing how amateur radio spans the globe.

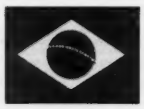
The stamp printed on the envelope depicts a radio operator wearing headphones and speaking into a microphone. This is superimposed over lines of amateur VK callsigns. (I looked, but mine's not there; curses!)

In all, very colorful, and good PR for both the WIA and amateur radio in general.

Renato Costa PT7AI.

Band	DX Station	South American Station
1.8 MHz	K1ZM	PY1BVY
3.5 MHz	OK2HI	CX8DT
7 MHz	DK3KD	LU4FC
14 MHz	DJ2PJ	PP2BT
21 MHz	EI3DP	PY1APS
28 MHz	DL3ME	LU2DGZ
Multiband	HA7KSR	PT2KT
Multi-operator	OK3KII	CX7BY

Fig. 1.



BRAZIL

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Brazil

SAO PAULO COUNTIES

To get a few Brazilian awards, rules for which we already published here, it is necessary to work as many as possible different cities in the state of Sao Paulo, the most populated state of Brazil. However, many of those cities don't have amateurs living there. Those awards, sponsored by the Brazilian CW groups, are available only for QSOs in CW.

So, trying to help us, two friends, Francisco Muller PY2RRG and Oswaldo Martinez PU2SCR decided to operate every Sunday from a different spot, specially along the coast of their state. In this way, they have already worked from Itaquacetuba, Biritiba Mirim, Mongagua, Salto, Elias Fausto, Caraguatatuba, Suzano, Mairipora, Peruibe, Poa, and Ferraz de Vasconcelos. Once in a while they return to a city already worked from before.

The operation is only on fifteen and forty meters and the usual frequencies are 21.030 MHz and 7.030 MHz. The equipment includes a Kenwood TS-180S, a Yaesu FT-101ZD, two QRP transceivers of about 10 Watts, and dipole antennas. The QSL information for PY2RRG/PY2 or PU2SCR/PY2 is PO Box 44329, Sao Paulo, SP, 03696, Brazil.

THE 1984 WORLDWIDE (CW) SOUTH AMERICA CONTEST

The WWSA Contest is sponsored by Grupo Editorial Antenna, and its rules were published in this column in April, 1985. Winners of the 1984 WWSA contest are shown in Figs. 1 and 2.

RENATO COSTA PT7AI

During my trips to northeast Brazil, due to my job, sometimes I have a chance to see friends who I never thought I'd meet personally. One of them was Renato Costa PT7AI. He is retired (and very proud because he is now a great grandfather). Renato was licensed only a few years ago, and since then he has become an avid DXer. He has 142 countries worked, most of them confirmed.

He's a very charming person—and don't lose the opportunity of a QSO when

Continental Winners

Single Operator	Multi-operator
Africa: EA5YU/EA8	Asia: JA6YAI
Asia: JH0BBA	Europe: OK3KII
Europe: HA7KSR	South America: CX7BY
North America: K8CW	
Oceania: KH6WT	
South America: PT2KT	

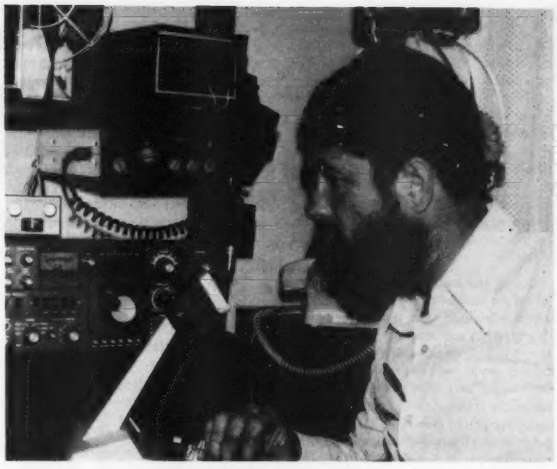
Fig. 2.

you hear him. QSL via PO Box 546, Fortaleza 60000, Ceara, Brazil.

GRGJR AWARD

Sponsored by the Boy Scout Amateur Radio Group Joao Ramalho, the GRGJR Award is available to all licensed amateurs for confirmed contacts with 3 (three) GRGJR members and 5 (five) different Brazilian prefixes (PY1, PY3, PP6, PY7, PS8, etc.). Contacts must have been made after March 1, 1984, on any amateur band and in any mode. No QSL. Send GCR list of stations worked (call, date, time, band, mode, and report) and 10 IRCs for mailing expenses to GRGJR Award, PO Box 466, 09500 Sao Caetano do Sul, Sao Paulo, SP, Brazil.

GRGJR members: PY2GJR, PY2CAR, PY2KQ, PY2EJ, PY2PNA, PY2ORK, PY2RTW, PY2AU, PY2DTR, PY2MDU, PY2RSF, PY2OWE, PY2NG, PY2GPA, PY2RG, PY2ON PY2MM, PY2VA, PY2CY, PY2ZY, PY2ASI, PY2FKF, PY2NYS, PY2LEV, PY2EHL, PY2USM, PY2UMV, and PY4PZ.



Francisco Muller PY2RRG.

CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

EME IN CZECHOSLOVAKIA

In the last ARRL EME contest, station OK1KIR made 45 contacts altogether, and by 36 multipliers gained 162,000 points. In the 145-MHz band, the operators of the station used a 4 x 10 yagi antenna (according to PA0MS) and they had contacts with DL8DAT, SM2GGF, K1WHS, WA1JXN/7, KB8RQ, and YU3WV, and they heard 25 other European and North American stations.

On 433 MHz they made contacts with JA6CZD, G4EZN, F1FHI, HB9G, YU1AW, DL9KR, N4GJV, WA1RWU, N9AB, WB5LUA, F2TU, K2UYH, I5MSH, WB0TEM, KD6R, VE4MA, DJ6MB, F9FT, F1FAN, G3LTF, OE9XXI, G3SEK, DF3RU, and EA2BK, and heard 20 other stations.

In the 2320-MHz band, they made contact with OE9XXI and heard only (559) WA4HGN, which was using a parabola with a diameter of 8.5 meters with a transmitter output of 400 Watts, and with W4HHK (539) that had a transmitter with the same output and a parabolic antenna with a 5.5m diameter. The signals of both stations were stable, without any fadings.

In the past I mentioned the station I0SNY several times in connection with its multiple breaking of the world record in the 10-GHz band. This time it broke the world record in the 24-GHz band at the end of August last year, when Nicola, after his previous experiments for the distances of 350 and 90 kilometers, agreed with the amateurs in the Calabria experiments with an advantageous route from the south of Italy to the island of Ischia near Neapol [Naples].

In connection with this advantageous route, it is necessary to mention that in its total distance of 331 km there was a distance of 40 km in its middle part in which the curved sea level obstructed the direct distance. In Calabria, there was a group of amateurs on Montalto (1956 meters high) in locator HY70j (JM78WE) and they were working under the callsign O8YZO/8. I0SNY was on Ischia in locator GA3Oa (JN60WR) above sea level by 788 meters. Although there wasn't direct visibility between the stations, it was supposed that an over-water ducting would be in the 24-GHz band just as by experiments recorded in the 10-GHz band. It also was confirmed, although with some problems, and thus the contact was kept for several hours by telegraphy, operating F2.

Both sides used metal-laminate parabolas and Gunnplexers with outputs of 30 mW. Automatic tuning of the frequency was by varactor diode HA4E 115, and the receivers had noise figures of 6 dB.

AMSAT-OSCAR 10 ACTIVITY

A couple of operators, OK2BX and OK2VTD, were boasting about their activity through AO-10-B. Zdenek OK2BX and Jozef OK2VTD were using the following setup: a vertically-polarized 10-yagi antenna to the receiver, the antenna amplifier with 3SK112, the transceiver according to DJ6HA, the teleprinter converter DK1AQ, and the machine RFT T-51; a 21-element yagi antenna for the transmitter, the transmitter Klinovec with the transverter on 435 MHz and PA (power amplifier) 20 W.

A perfect list of teleprinter signals of the beacon GB and an announcement about their finishing of AFSK for the transmitter were enclosed with their letter. The first Czechoslovak teleprinter contact through AO-10 has already become a reality. Also, Jenda OK2EH has sent a few lines about his work. Since the end of April till the beginning of October last year, he had made 150 contacts on CW with 56 DXCC countries. He mentions that the first contact during his first experiments would have been successful earlier if he had been able to find his own signals in the downward route! A changed "solar angle" (being changed between −60° to +60° during a 7-month period) was confusing him. The output of a solar battery that is at its largest value at 0° is connected with this fact. The operational schedule is updated periodically and announced telegraphically by beacon GB and also on RTTY.

GREAT BRITAIN

Jeff Maynard G4EJA
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Cheshire
England

Like most of Europe, the UK is keen to promote the adherence to band plans, particularly in the VHF and above allocations. This is not to impose some kind of bureaucracy on active amateurs but to ensure that good sense prevails and that everyone has a fair share of the space available.

There are, of course, those vociferous minorities who cry "foul" at any attempt to regulate what ideally should be a freely-available resource. These protesters fall into two broad categories—the anti-rule brigade and the "I'm right" brigade.

The anti-rule people are opposed to band planning for essentially ideological reasons. They do not think that anybody (least of all the RSGB) has any right to impose an arbitrary set of constraints on a frequency spectrum that, in technical terms at least, is fully available. These are the people who think they must demonstrate their point of view by ignoring any set of rules or plans.

Thus, you will hear an SSB CQ being called in the middle of the designated FM subband. Needless to say, the call is not answered and only serves to annoy somebody trying to stick to the rules. I suspect this same group of people would be ardent supporters of band planning if the official view was that no band plans would be defined.

The second group of people is much more dangerous (to society at large—not just to radio hams). These are the people who, for example, decry FM as not being "proper radio," and therefore seek to deny its adherents any frequency space. (You also get, of course, those opposed to RTTY, to SSTV, to SSB, *particularly* to repeaters, and so on.)

Any licensed ham is free to choose the modes or bands he wishes to use. No ham is, to my knowledge at least, forced to adopt any particular method of operating against his wishes. This is how things should be, but merely not liking something does not make it wrong. I have no objection to the ham who has CW QSOs only—but equally he has no right to deny my interest in, say, RTTY.

The multifaceted nature of amateur radio has much to do with its attraction to a great many of its fans. It is precisely this variation that sensibly leads to the development of band plans. I do not think that band planning is an imposition on the way I operate. On the contrary, it gives me a good idea where to look for particular types of signals or where to go to avoid another type.

The UK band plans are specifically devised to provide an ordered framework within which everyone has the opportunity to do his own thing. I wish this philosophy could be applied to some other aspects of my daily life.

The two most important band plans

Moonbounce	144.000	432.000
CW calling	144.050	432.050
MS CW reference	144.100	
SSB calling	144.300	432.200
MS SSB reference	144.400	
SSTV calling	144.500	
RTTY calling	144.600	432.600
Data fx calling	144.675	432.675
FAX calling	144.700	432.700
FM calling	145.500	433.500

Table 1. Spot frequencies for 2m and 70 cms.

		432.000	CW only
144.000	CW only	432.150	SSB and CW
144.150	SSB and CW	432.500	All modes
144.500	All modes	432.800	Beacons
144.845	Beacons	433.000	FM repeater outputs
145.000	FM repeater inputs	433.400	FM simplex channels
145.200	FM simplex channels	434.600	FM repeater inputs
145.600	FM repeater outputs	435.000	Satellite and ATV
145.800	Satellite service	438.000	ATV
146.000	Band edge	440.000	Band edge

Table 2. 2m band plan.

Table 3. 70-cm band plan.

Channel	Input	Output
R0	145.000	145.600
R1	145.025	145.625
R2	145.050	145.650
R3	145.075	145.675
R4	145.100	145.700
R5	145.125	145.725
R6	145.150	145.750
R7	145.175	145.775

Table 4. 2m repeater allocations.

Channel	Output	Input
RB0	433.000	434.600
RB1	433.025	434.625
RB2	433.050	434.650
RB3	433.075	434.675
RB4	433.100	434.700
RB5	433.125	434.725
RB6	433.150	434.750
RB7	433.175	434.775
RB8	433.200	434.800
RB9	433.225	434.825
RB10	433.250	434.850
RB11	433.275	434.875
RB12	433.300	434.900
RB13	433.325	434.925
RB14	433.350	434.950
RB15	433.375	434.975

Table 5. 70-cm repeater allocations.

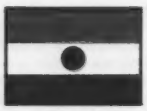
(and the ones I will describe in detail) are for 2 meters and 70 cms. Each plan nominates a number of spot frequencies as well as defining areas of each band for particular types of emission.

Spot frequencies (see Table 1) are given for calling in most modes (CW, SSB, FM, RTTY, SSTV, FAX, data, etc.) and there are definitions for MS and moonbounce working and reference. A particular 2m frequency (145.525, channel S21) is nominated for broadcasts of GB2RS, the RSGB service.

Tables 2 and 3 show the broad divisions of each of the bands according to mode. The major difference is in relation to repeater input/output pairings. In the 2m band, repeater outputs are 600 kHz above their respective inputs, whilst in the 70-cm band, repeater outputs are 1.6 MHz below their respective inputs. Tables 4 and 5 show the repeater input and output frequencies and their channel designations.

Channel numbers are also allocated to the simplex channels that fit, in each band, between the repeater input and output frequencies. Simplex channels are spaced, like repeater channels, at intervals of 25 kHz.

Two-meter simplex channels are from 145.200 (numbered S8) through to 145.575 (and numbered S23). The FM calling channel is known as S20 (145.500). Seventy-centimeter simplex channels are from 433.400 (SU16) to 433.600 (SU24). The 70-cm FM calling channel is 433.500 (SU20).



INDIA

Miss R. Subha
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Post Box 725
Madras 600 006
India

INDIA'S ONLY BLIND HAM

A small village a hundred miles away from Madras, served by a feeder-route bus service, had the unique privilege of having been the destination of the largest number of hams ever to have visited an Indian village. This little place—Chatram—cannot be found even on the district map, but it is known to most 40m operators, DX and Indian, as the home of India's first and only blind ham, VU2TTC.

Chakravarthy, popular on the band as Chak, lost his sight due to detachment of the optic nerve shortly after taking his Master's degree in mathematics. Disabled but not defeated, he took up electronics as a hobby and soon was on the doorstep of amateur radio. The Amateur Station Operator's Certificate (ASOC) examination appeared insurmountable, but he solved problems as they arose. Learning of radio theory and regulations, he managed with the help of his nephew, Govindarajan, who read out loud to him. He learned Morse code through a Morse-code record given by the late VU2GW and cassettes from VU2MO.

During the learning period, Chak had joined the Madras Amateur Radio Society, which interacted with the licensing authority (WPC) and obtained permission for him to use his nephew as a scribe. Govindarajan would read out the question and Chak would reel off the answer, which was faithfully transcribed. Two WPC officials stood by to make sure that the high-school-going nephew did not add his own wisdom to the answers.

Chak came out with flying colors and in due course (generally a year in this country) he was assigned his callsign, VU2TTC. Where to find a rig? Those were the days before liberalization, and one had to build or smuggle in equipment. Chak built a single-frequency crystal-controlled QRP transmitter and used it with a Philips domestic 3-band transistor receiver. His first contact was with VU2MKS on 7010 kHz on March 9, 1979.

After a while, VU2APS helped him build a rig with an 807 final and a vfo. In the first two years, Chak ran up an impressive total of 10,000 contacts, local and DX, all on the 40-meter band in CW and AM modes!

VU2TTC is today a byword among the SWLs in this part of the country, to be found on the 40-meter band every morning, ready to have QSOs with newcomers taking their first hesitant steps or old-timers trying to test their top CW speed. A teacher by profession, Chak readily helps all newcomers with advice and tutoring in radio theory and Morse code.

Chak recently had a pleasant experience. He received a used Yaesu FT-7 as a gift from Steve DJ1US. Though he anticipated difficulties in clearing the gift through customs, it was surprisingly smooth sailing, thanks to VU2MV who accompanied him to the customs office. The customs officers were nice enough to deliver the parcel to him at Madras instead of sending it along a further 100 miles through the mails.

At the time of writing this, a linear to go with the FT-7 is on the way as a gift from Kazu JJ1TZK; Chak can look forward to allband operation in the near future.

If you hear VU2TTC, please do have a word of appreciation for a man who has not allowed blindness to stand in the way of meaningful, active life—something unusual in this part of the world.

Photos by 4Z4MK

Drawing winning raffle tickets at the hamfest. Left to right, Tuvia 4X4GT, IARC treasurer, Naomi 4X6DW, secretary and hamfest organizer, and Yankele 4X4AH.

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

THE BAR ILAN HAMFEST—THE OLD-TIMERS REMEMBER

On Saturday evening, March 30, 1985, the Israel Amateur Radio Club held its annual hamfest and social gathering in the banquet hall of the Bar Ilan University near Tel Aviv. Among the highlights were a buffet, a display of the latest gear from the Israeli distributors of Kenwood and Yaesu, a raffle of gear ranging from handie-talkies to computer accessories, and the awarding of prizes to the winners of the recent IARC QSL card contest.

The main feature of the evening was the calling up to the podium of a number of seasoned old-timers who recounted tales of their experiences in ham radio in the pre-state days and the early period of the independence of our country.

The first to speak was Shlomo "Sioma" Manzari 4X4BX, who told that in the days of the British Mandate of Palestine, ham radio was strictly forbidden, the holding of transmitting equipment considered a criminal offense punishable by death. Nonetheless, the amateurs organized themselves, issuing themselves Palestine callsigns. Shlomo was "assigned" ZC6SM. He recalled that a friendly British officer, a ham, brought them their QSL cards from the RSGB.

In 1948, when the state of Israel was proclaimed, the government at first did not want to allow ham-radio operations. Arguing with the authorities, the hams stated that they had not feared the British hangman's noose previously, and should they not be granted licenses, they would continue their operations clandestinely. As we know, the amateurs won out, the first 4X4 calls were issued, and Shlomo became the first president of the new Israel Amateur Radio Club.

Froike 4X4AF brought down from his attic a box of memorabilia which included a license granted by the British authorities to operate a shortwave receiver, stipulating a maximum antenna length and height of 30.5 meters, and stating that exceeding these directions would result in criminal proceedings. Of course, Froike operated as ZC6AF. He displayed QSL cards from

Shoshana Kirschner 4X6OL and Aharon 4X4AT, IARC president.

Froike 4X4AF shows QSLs from the early days of Israel's independence.

BACK ISSUES

March 1984
Space Shuttle extravaganza

April 1984
Inside Dayton, easy signal monitor, four-band mobile whip

May 1984
Spring antenna issue—9 projects!

June 1984
Transistor tester, frequency counter, VIC-20 Morse

July 1984
Dayton photo-journey, cordless phones, construction methods

August 1984
Two-tone tester, HW-101 mods, kW for 160

September 1984
V/UHF wattmeter, Timex RTTY system

October 1984
Fall antenna issue—9 skyhooks!

November 1984
Color Computer SSTV, TVI cure

December 1984
Touchtone data display, transistor tutor, line conditioner

January 1985
ICOM mods, extra VIC-20 memory, shoestring RTTY

February 1985
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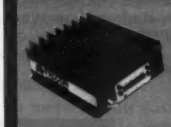

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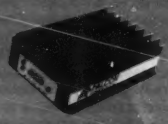

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Jordan, Syria, and Saudi Arabia, indeed rare prizes, and a card from ZC6JM, the station of the American Consulate in Jerusalem.

Yankele 4X4AH had a different kind of experience on the air in the days prior to Israel's independence. Working with a nationalist group, he set up an ARC-5 Command Set transmitter with a carbon microphone and originated twenty-minute broadcasts to the general public, changing locations for each transmission.

The affair went without a hitch for about a year, until one day, five minutes into the broadcast, one of the group burst into the room from which they were broadcasting in Tel Aviv to say that they were surrounded by British soldiers and police. To this day, Yankele thinks that someone informed on them, as in those days direction-finding equipment was most primitive, and there is no way they could have been DFed in such a short time.

Yankele and his friends were arrested, and as a punishment, Yankele was exiled to British prison camps in Eritrea and Kenya, being allowed to return home only once the state of Israel was proclaimed. Yankele enlisted in the Israel Defense Force's Signal Corps, where his boss was Joe Berr 4X4AA. Yankele was bitten by the ham-radio bug, and soon earned his first amateur-radio license.

Shimshon 4X4GF (Gefilte Fish) was a member of the pre-state underground Hagana forces that were concerned with the bringing in of refugees from Hitler's death camps in Europe, running the British blockade of the then-Palestine coast. He became a wireless operator in the Hagana net that coordinated the illegal immigration operation. Like Yankele, when Israel gained independence, Shimshon was bitten by the ham bug, and the bands have never been the same since.

For many of the hams present, these stories were a living history lesson. Today we all take ham radio for granted, yet the stories of the old-timers here brought back a period that today is difficult to imagine.

Special thanks go out to Naomi 4X6DW, who worked very hard to organize and see through this hamfest. A few hundred amateurs plus their XYLs, YLs, or OMs were present, and the sale of raffle tickets bolstered the club's treasury substantially, so that financial support for the coming year's activities is ensured.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

At the beginning of September, 1984, the central radio station of PRAA (Polish Radio Amateurs Association) began to transmit broadcasts of information and to establish contacts separately from the Radio Information Bulletin of PRAA, on every Sunday at 1030 local time on 3700 kHz (SSB) and 7060 kHz (AM). Furthermore, informative SP5PZK broadcasts are transmitted every Wednesday at 1700 local time on 3700 kHz. Broadcasts of PRAA include the latest news, announcements from PRAA headquarters, advisory service, accounts of hams' ventures, and technical information.

After the broadcasts, operators of SP5PZK establish contacts with radio amateurs and provide reports on broadcast audibility, wait for information concerning all radio amateurs, and answer questions. At first, SP5PZK establishes contacts with foreign stations, and next with SP in a district order. Radio station SP5PZK has been installed in the PRAA Office (Warszawa Jaracza 2) and uses transceiver TS-520 and delta-loop antenna for shortwave. Simultaneously for local receivers there are broadcasts on 144 MHz FM with radiotelephone FM-302 and an omnidirectional antenna with vertical polarization.

The oldest, most active DX Club of PRAA commemorated its 25th anniversary in 1984. The club was founded by SP7HX, SP3PL, SP8CK, SP5HS, and SP2AP on June 9th, 1959. During its 25 years of existence, members of the club met each other at 15 rallies in different locations in Poland. The 16th rally took place in Bocheniec near Kielce on October 6–7, 1984. Over 130 members, would-be members, and friends of the club heard a presentation of the outgoing president, SP9ZD. He gave an account of the 25 years of activity of the club and discussed some real organizational problems.

Constant issuances of licenses was a topic for discussion. Proposed amendments to laws regulating hams' activities in Poland, new proposals for extension of radio amateurs' rights relative to new bands of SW, and mobile and portable modes were other subjects of discussion. Transmission and reception demonstrations on CW and RTTY with a minicomputer, by SP5DED, aroused great interest among the participants.

SP9CTW reported results of Intercontest KF 1981. 224 SP stations entered, of which 180 were classified as individual. The champion of Intercontest in mixed and phone categories was SP9HWN; in category CW—SP6FER, and in the club radio station category—the SP2PDI team.

The next XVII rally of SPDX Clubs will take place in 1985, if a district board of PRAA undertakes resolving hardships.

On January 20, 1985, from 0800 till 1000 local time, Polish RTTY contests were arranged by the district board of PRAA in Leszno, on 3.5 MHz, call "CQ SP."

The best Polish stations that took part in OKDX Contest 1983 were:

- Single op, multiband—SP5GIQ; 1.8—SP3GVX; 3.5—SP8EMO; 7—SP4EEZ; 14—SP7MGD; 21—SP2NA; 28—SP6BFK.
- Multi-operator, multiband—SP8ZHY.

The best Polish stations that took part in PACC Contest 1984 were:

- Single op, multiband—SP5EXA, SP6AEG, SP3LPR.
- Multi-op, multiband—SP9KJT, SP7KTE.

The best Polish SWL in this contest was SP93110KA.

PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

This time you will read about a DXpedition organized by a few Portuguese hams during the last WPX contest, in March. It was to the Island of Berlenga, a beautiful place surrounded by water which is nice and clear; there is not any sort of pollution down there. We also cannot find any medieval architecture (HI), but an old but nice lighthouse can be seen.

Our thanks to Luis CT4NH who kindly sent us the following report:

Myself and CT4UW, we've been thinking about repeating the operation from Berlenga Island, still with the very special call, CT8BI. We decided together with the others to make the first-ever serious multi-multi effort from CT-land, during the *CQ* WPX SSB Contest!

For success, we had almost all the necessary ingredients: one island, a rare prefix, and a fantastic team composed of Joe CT1AOZ, John CT4UW, Joe CT1BOH, and the author (CT4NH) with the precious help of our old friend Commander Patricio (Portuguese Navy Officer). Weather conditions were very good on the west coast of Portugal—only a few windy days.

We installed, after a routine voyage, 4 stations with their antennas, and CT1AOZ, with his Machiavellian (and efficient) system on 160 meters. The island has outstanding conditions for Top Band. I was just active on 40m; on 20 and 80 we had CT1BOH, and on 10/15, CT4UW.

But Murphy was there!

Power on the island was about 170 volts instead of the 220 ac necessary as a minimum for the linear amplifiers (Drake/Yaesu), with great variations! Then, just 20 minutes before the contest started, I heard CT1BOH shouting, very excited, "I've no antenna! Oh, that Murphy!" The wire had come down with the strong winds. Everybody ran upstairs (I mean more than 300 steps) to the top of the lighthouse in the deep night to replace the antenna!

Well, after that, our multi-multi was started at 0010 precisely, by CT1BOH, with very very poor propagation except on 20.

I think CT1AOZ worked everybody around 160m! (Some of them twice.)

Other minor problems included CT4UW's TH3JR disintegrating in the wind—but replaced because we also declared war on Mr. Murphy (HI HI).

Excellent meals were prepared by Commander Patricio, who got a nice tan in the bright sun of this marvelous island while we worked up a very nice score (we hope):

QSOs totals:

1.8 MHz—350	14 MHz—2000
3.5 MHz—370	21 MHz—380
7.0 MHz—300	28 MHz—0

Believe it or not, propagation was in very bad shape on 28. Our total score was 697 prefixes.

We hope sincerely to be there next year to give you the opportunity to work Berlenga Island and receive its marvelous QSL card. Contacts with CT8BI are valid for the IOTA Award, having for this purpose the reference EU-40.

The QSL manager for this operation is CT4UW, and the QSL cards might be sent via *Callbook* address.

VISITORS IN LISBON

Last April we had Frank Rose W1TIV from Cape Cod, Massachusetts. Frank and Irene were here in my shack for a while. Next time I write I will bring you more news about Frank's trip.

73 from Portugal and good DX.

SWEDEN

Rune Wande SM0COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

THE FIELD AWARD

The Board of the Swedish Amateur Radio Society, SSA, has taken the decision to issue The Field Award to licensed radio amateurs for verified contacts with, and to shortwave listeners for verified reports from, other radio amateurs in a number of fields. These fields are defined by the Locator System adopted by IARU as of January 1, 1985 (The Maidenhead Locator). Contacts on or after this date are valid for The Field Award.

The Field Award is issued for verifications of fields in four classes:

Platinum—	All 324 fields
Gold —	300 fields
Silver —	200 fields
Bronze —	100 fields

All bands for amateur radio and all modes are permitted. No endorsements will be issued. All contacts must be made with stations on the surface of the earth. The contacts shall be verified by regular QSL cards or equivalent, on which the field is clearly stated (or the position, with such accuracy that the field can be determined). The term "position" refers to longitude and latitude or to the name of a place or a town.

If there is any uncertainty about a field, SSA may require additional information

WPX Contest on Berlenga Island last March. Left to right, John CT4UW, Joe CT1AOZ, Commander Patricio, Luis CT4NH, and Joe CT1BOH. (Photo by CT4NH)

before approving the contact. If the uncertainty remains, the contact will not be approved for the award.

The application shall be made on a GCR list, containing the information from each QSL card which is required for approval. The GCR list shall be verified by the award manager or other official of the national amateur society in the country of the applicant. A random sample of individual QSL cards may have to be made and sent to SSA for checking, if requested.

The fee is 30 Swedish kronor, 10 IRCs, or $US4.00; the application address: The Field Award Manager, Sveriges Sandareamatorer (SSA), Ostmarksgatan 43, S-123 42 Farsta, Sweden.

WORLD ATLAS

Folke SM5AGM, the father of the world locator system (The Maidenhead Locator), has produced a world atlas (field map) which enables you to determine the field of the station worked. This world atlas should be available at your national amateur-radio society or can be ordered from SSA at the address above by sending a large size (A4) SAE and 6 IRCs. A presentation of SM5AGM and his work with this locator system will be made in a future column.

7S-SSA SPECIAL-EVENT STATIONS

This year of 1985, Sveriges Sandareamatorer celebrates its 60th anniversary. The Swedish licensing authority gave the SSA the opportunity of using the very rare 7S prefix for this occasion during the period April 28 to May 31, 1985. Various radio clubs were part of this activity by being able to use the special call for certain club activities for a few days each. There was one special call on the air from each of the 8 call areas, i.e., from 7S1SSA to 7S7SSA and 7S8SSA. If you have worked all 8 special-event stations you may apply for a "Worked All 7S Award." The license for this special prefix was issued on April 23.

CTM

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—J. Trenbick

"...always stop to read CTM, even though most other magazines I receive (and write for) only get cursory examination."
—Fred Blechman, K6UGT

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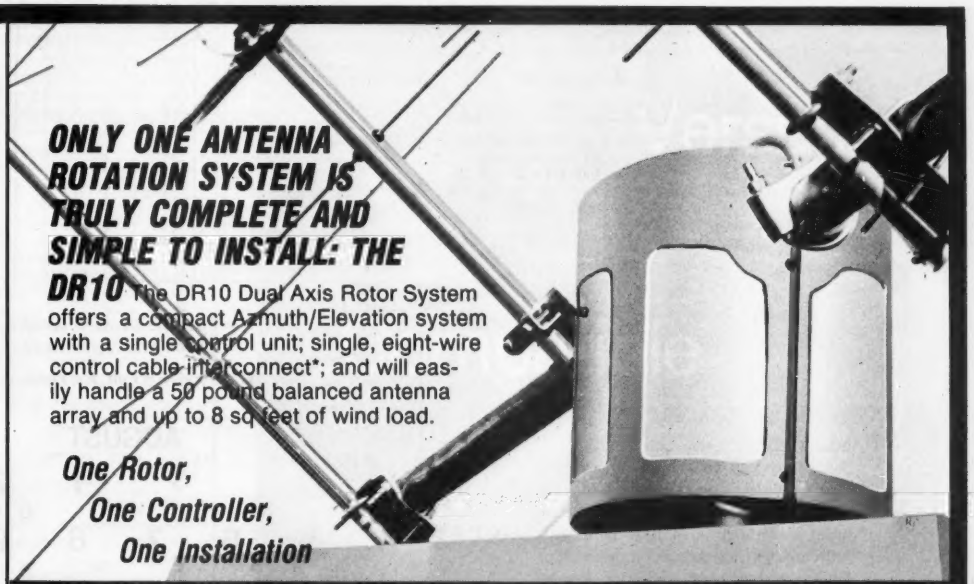
THE DR10



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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U. S. S. R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U. S. S. R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U. S. S. R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 F
4 P	5 P	6 F	7 F	8 P	9 P	10 P
11 F	12 F-G	13 G-F	14 P	15 P-F	16 G	17 F
18 F-G	19 G	20 G-F	21 P	22 P	23 P	24 P-F
25 P	26 F	27 F-G	28 G	29 P	30 P	31 P-F

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What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH.*

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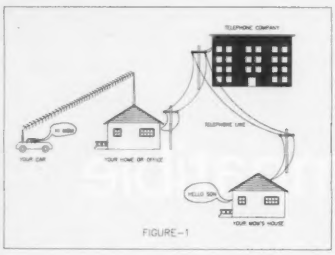
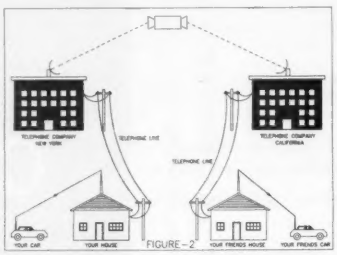
To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!



FIGURE–1



FIGURE–2

How To Use *SMART PATCH*

Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

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- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
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- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

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Powered by an 8-bit Central Processing Unit, the ten-channel memory of the FT-726R stores both frequency and mode, with pushbutton transfer capability to either of two VFO registers. The synthesized VFO tunes in 20 Hz steps on SSB/CW, with selectable steps on FM. Scanning of the band or memories is provided.

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The optional SU-726 module provides a second, parallel IF strip, thereby allowing full duplex crossband satellite work. Either the transmit or receive frequency may be varied during transmission, for quick zero-beat on another station or for tracking Doppler shift.

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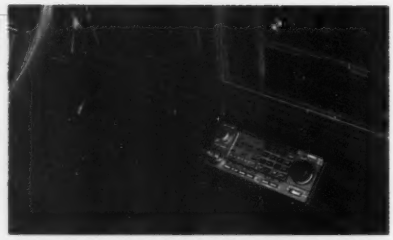

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TR-7950 optional accessories:

- TU-79 three frequency tone unit
- PS-430 power supply
- KPS-12 fixed-station power supply for the TR-7950
- KPS-7A fixed-station power supply for the TR-7930
- SP-40 mobile speaker
- SP-50 mobile speaker
- MC-55 mobile microphone
- MC-46 16-key autopatch UP/DOWN microphone
- SWT-1 2 m, 100 W antenna tuner
- SW-100A/B power meters
- PG-3A noise filter

Model TR-7950 (45 watts) shown. TR-7930 is identical, but with 25 watts output.

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

More TR-7950/7930 information is available from authorized Kenwood dealers.

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